BORD NA MÓNA

ENVIRONMENTAL PRODUCTS U.S. INC.

STATE OF WISCONSIN

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DESIGN & INSTALLATION COMPONENT MANUAL

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PURAFLO® PEAT FIBER BIOFILTER

CLASS I
NSF/ANSI
STANDARD 40

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Puraflo

WASTEWATER TREATMENT

REV. 12/2010

BORD NA MÓNA

ENVIRONMENTAL PRODUCTS U.S. INC.

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1.0 GENERAL DESCRIPTION OF SYSTEM

The Puraflo® Peat Fiber Biofilter is an advanced secondary treatment system that purifies septic tank effluent to an extremely high degree before final dispersal.

A typical Puraflo® Peat Fiber Biofilter system consists of:

- ➔ Septic tank with a commercially-rated effluent filter connected to the tank outlet pipe
- ➔ Dosing tank and effluent pump, or siphon, to accommodate dosing of the septic tank effluent onto the peat fiber media
- ➔ Biofilter modules where advanced treatment occurs due to the physical, chemical and biological
- ➔ processes that are optimized in the peat fiber media.
- ➔ Site specific, final effluent dispersal system

The filtered septic tank effluent is collected under gravity in the pump tank. A timed-dose system is activated by a programmable timer or a siphon-dose system triggers, which pumps the effluent through a flow splitting inlet manifold located at the base of the treatment modules. An orifice plate is located inside the top of each inlet manifold which allows the flows to be split equally and fed simultaneously to each Biofilter module. The inlet manifold is connected to the base of the Biofilter module and is fed upwards to a rectangular distribution grid located 6 inches below the top of lid. The effluent percolates laterally and vertically through the depth of the peat fiber treatment media and emerges as a clear, innocuous liquid from the base of the system. The treated effluent is then collected and dispersed.

The Puraflo® Peat Fiber Biofilter System has been tested, certified and listed by the National Sanitation Foundation, International as meeting the requirements of NSF/ANSI Standard 40, Class 1. Puraflo® is a modular system with each module rated for 150 gallons per day (gpd). The range and rated capacity of the system is therefore a multiple of the standard unit based on the 150 gpd per module. Model P150N*3B, incorporating 3 modules and rated at 450 gpd, was the treatment plant tested to NSF/ANSI Standard 40.

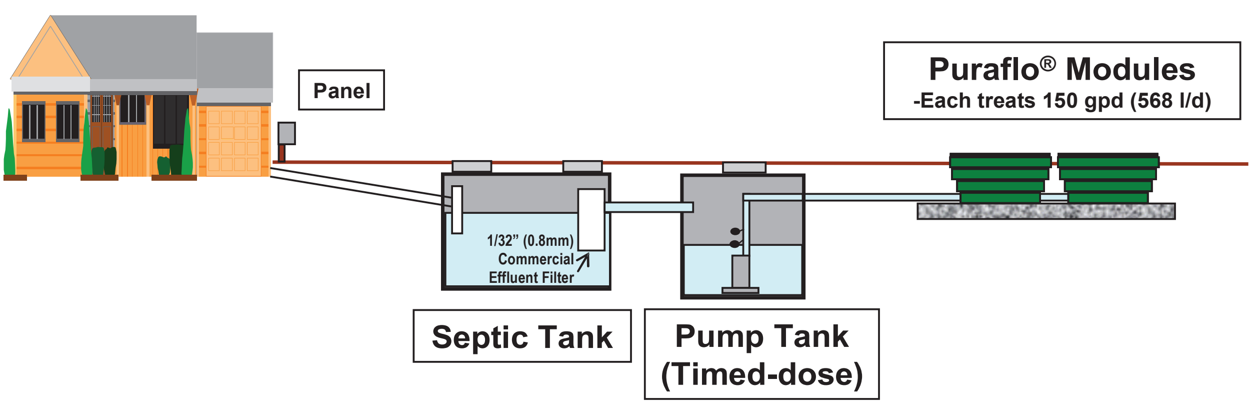


Figure 1. Typical Puraflo® schematic (shown without drainfield)

2.0 PROCESS FUNDAMENTALS

2.1 Treatment Mechanisms

The Puraflo® Peat Fiber Biofilter treatment technology is based on simple, passive biofiltration principles. The treatment of the effluent within the system is achieved by a combination of unique physical, chemical, and biological interactions between the effluent and the fibrous peat media. The residence period or contact time in the media at the design loading rate has been calculated and demonstrated to be somewhere between 36 and 48 hours by using tracer organisms.

Extensive scientific examination of the peat fiber media has revealed a complex structure which permits a number of separate treatment and attenuation processes to occur simultaneously. The treatment mechanisms within the fixed film media are summarized in Table 1 below.

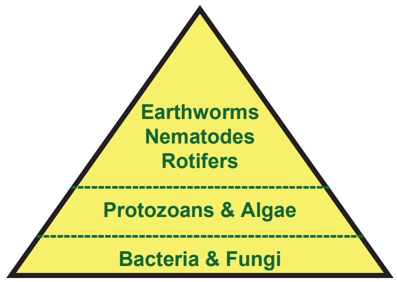
TREATMENT	CHARACTERISTICS	SIGNIFICANCE
Physical	Surface area	Greater the surface area, greater the contact between effluent, air and media
	Void Space	Open fibrous structure & large pore volume results in efficient transfer of air and effluent throughout the Biofilter
	Bulk density	Low bulk density media – light open material resulting in large surface area and void spaces, characteristics attractive in respect to wastewater treatment.
Chemical	pH	Pathogenic bacteria in wastewater undergo significant die-off in peat due to the acidic conditions prevailing and the predation/competition from naturally occurring pH tolerant microfauna.
	Cation Exchange Capacity (CEC)	Peat particles tend to be negatively charged. This gives peat a great ability to absorb positively charged molecules. A high CEC means the peat can effectively hold positively charged molecules including ammonium, metals, pesticides, some organic molecules and possibly viruses.
	High Adsorptive Surface Area	The larger the surface area the greater the number of adsorption reactions taking place
Biological	Buffering Capacity	The ability of the system to withstand shock loadings
	Resistance to Degradation	Due to a high lignin content, peat fiber is resistant to breakdown or decay thus prolonging the lifespan of the media
	Beneficial organism growth	Biological treatment achieved by complex and diverse microflora which adhere to peat fiber media. Microflora largely composed of aerobic and facultative aerobic heterotrophic bacteria from different genera. Supports higher life forms : protozoans, rotifers, algae, insects, nematode and annelid worms.

Table 1.

2.2 Microbiology of the System

In a mature peat fiber unit the biological processes are known to be crucial in maintaining the treatment efficiency observed. The bulk of the treatment and assimilation processes are achieved by diverse microflora which adhere to the surface of the peat media. This microflora is largely composed of aerobic and facultative aerobic heterotrophic bacteria from a large number of genera. The most important bacteria genera represented include:

- ➔ Pseudomonas
- ➔ Aeromononas
- ➔ Bacillius
- ➔ Micrococcus
- ➔ Flavobacteria
- ➔ Alcaligenes
- ➔ Streptococcus



The total bacterial population recorded per gram of peat has been measured at $1x10^9$ cfu's. Similarly, high numbers (up to $1x10^7$ cfu/g) of fungal organisms have been isolated from the Puraflo® units. A wide variety of "higher life" forms have also been recorded within the media matrix (ranging from protozoans, rotifers, and algae to nematode and annelid worms, insects and their larvae). These organisms play an important role in keeping the bacterial population "in check" thereby maintaining balanced microflora and ultimately a stable ecosystem.

The larger numbers of heterotrophic bacteria are found in the upper portions of the filter media with nitrifiers becoming more prevalent at depths of 12" or greater. Therefore, the degradation and assimilation of the carbonaceous elements of the waste is affected within the upper portions of the filter bed with nitrification occurring at greater depths.

The peat fiber system is also very effective at eliminating enteric bacteria contained in the waste. The anti-microbial properties of the system can be classified under two broad headings:

- ➔ Aggressive nature of the peaty media

The anti-microbial properties of the acidic peaty soils are developed through the low pH which directly affects the cell walls of the organisms in addition to limiting the amounts of nutrients available for uptake. Also, the trace amounts of phenols, bitumes and other complex hydrocarbons which are associated with peaty materials are directly toxic to certain bacteria, in particular enteric organisms which find themselves in a hostile environment (low temperature, high competition, etc.) and are already in a stressed condition. Finally, certain peaty soils have been demonstrated to contain a significant fungal species population (in addition to certain actinomycetes) which produce antibiotics and thus can adversely affect bacterial species in the zone of influence. It is important to note that the natural anti-microbial properties of the peat fiber media are only effective on the "stressed" enteric organisms contained in the primary wastewater. The indigenous microflora associated with the treatment media are largely unaffected by the properties described.

- ➔ Microbial antagonism

The second means by which the enteric organisms are extinguished in the Puraflo® system is by microbial antagonism. This simply means that the stressed micro-organisms within the primary wastewater are out competed by the indigenous microflora. The low temperature, low pH and production of certain microbial toxins within the peat fiber media adversely affects the "foreign" organisms. As such, they are largely ineffective in assimilating nutrients and other constituents, which are necessary for their survival. The large retention time in the peat fiber media ensures maximum lethality.

2.3 Treated Effluent Quality

When treating domestic strength wastewater (300 mg/l BOD_5 or less) up to the design flows and loads, a properly maintained Puraflo® Peat Fiber Biofilter system will exceed the performance requirements of NSF Standard 40 Class 1. Actual NSF test results established through analytical methods described in NSF/ANSI Standard 40 averaged 2mg/l $cBOD_5$ and 2 mg/l TSS.

PARAMETER	NSF Std 40 Avg, 30-day	Puraflo® Effluent Avg
$cBOD_5$ (mg/l)	25	2
TSS (mg/l)	30	2
pH (pH units) range	6 - 9	6 - 7.5

Table 2.

Additional NSF testing results are reproduced in the following table.

PARAMETER	Puraflo®, Avg
Total Nitrogen	>70% reduction
NH_3-N (mg/l)	<1
Fecal Coliform elimination	99.9% removal

Table 3.

The pH, $cBOD_5$ and Suspended Solids (TSS) concentrations demonstrated in this table will be attained within a few weeks of commissioning and will be consistently achieved over the lifetime of the peat fiber media.

Also, the treatment efficiency in the peat fiber media is not subject to significant variation with ambient air temperature fluctuations.

3.0 MEDIA FILTERS

3.1 System Features

The Puraflo® Peat Fiber Biofilter system has been part of numerous field studies and observations. Keys aspects of single pass media filters are:

- ➔ Primary treatment (septic tank)
- ➔ Septic tank effluent screening (effluent filter or screened pump vault)
- ➔ Timed-dosing in small, even increments
- ➔ Hydraulic loading
- ➔ Organic loading
- ➔ Air ventilation
- ➔ Media properties
- ➔ Media depth
- ➔ Media replacement or adjustment

Using the criteria listed above, the following table gives a technology summary. The Puraflo® Peat Fiber Biofilter (1 modules) loading is 150 gpd (568 l/d) and 300 mg/l $cBOD_5$ (NSF Standard 40 maximum loading).

ITEM	PURAFLO® PEAT
Primary treatment (septic tank)	Yes
Effluent screening	Effluent filter 1/32" filtration
Timed-dosing (doses per day)	12
Air ventilation	Surface access (holes in side of module lid)
Area	26.93 ft^2
Hydraulic loading	5.57 gpd/ft^2
Organic loading	0.0140 lbs $cBOD_5/ft^2/d$
Media depth	24"
Media void space	90 - 95%
Water holding capacity, % volume	50 - 55%
Media size	1 - 10mm
Media surface area	52,000 ft^2/ft^3
Media replacement	~15 years
Effluent $cBOD_5$, typical	<10 mg/l
Effluent TSS, typical	<10 mg/l
Effluent fecal coliform range, geo mean	<200 - <2,000 per 100 ml

Table 4.

Some Table 4 values derived from:

1. Loudon, T.L., T.R. Bounds, J.R. Buchanan and J. C. Converse. "Media Filters Text." *in* (M.A. Gross and N.E. Deal, eds.) University Curriculum Development for Decentralized Wastewater Management. National Decentralized Water Resources Capacity Development Project. University of Arkansas, Fayetteville, AR. 2005.

3.2 Comparison of Puraflo® & Single Pass Sand Filter Treatment

To review, the Puraflo® Peat Fiber Biofilter and the Single Pass Sand Filter, employ three main treatment mechanisms:

- ➔ Biological
- ➔ Chemical
- ➔ Physical

The media properties dictate the level of treatment expected under each mechanism. Within a mature media filter (all types), biological treatment predominates, confirmed by the following statements:

- ➔ The effluent from this sand filter during the experiments was purer than many drinking-water supplies, and the last published analyses. after the tank has been in operation 14 years, indicate that the sewage that was applied to it in 1901 was freed from 89 per cent. of its organic impurities. At first thought, this purification might be attributed to the fact that the sewage is strained through the sand. Such is not the case, however. Most of the organic impurities have been absolutely destroyed or transformed into other and inoffensive combinations, mainly through the action of bacteria.[1]

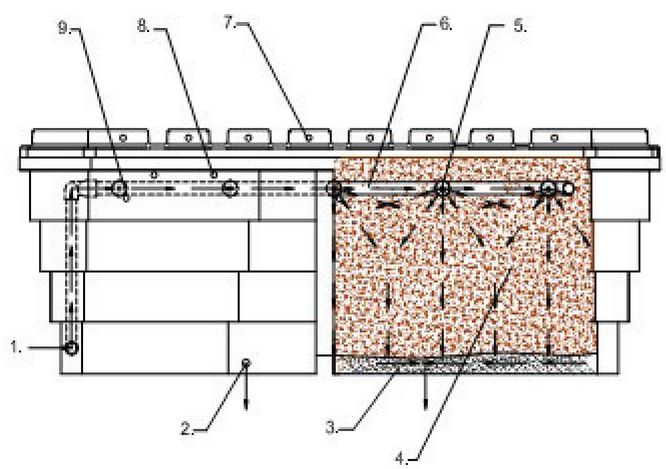
- ➔ Treatment filters using sand or peat as media make effective attached growth systems. They can be designed as either single-pass or recirculating filters, meaning that the wastewater is run across the media more than one time. Regardless of the media, the process is generally the same–wastewater from the septic tank is allowed to run through a bed of media and collected from underneath. Treatment occurs as the bacteria grows on the media.[2]

- ➔ As the wastewater passes through the sand filter, treatment is accomplished through physical and chemical means, but mainly by microorganisms attached to the filter media.[3]

- ➔ A biologically active film of organisms forms on the surface of the media. Microorganisms play an essential role in treating the wastewater as it flows over media surfaces. Certain bacteria known as primary colonizers attach (via adsorption) to the surfaces and differentiate to form a complex, multi-cellular structure known as a biofilm.[4]

- ➔ The bulk of the treatment and assimilation processes are achieved by a diverse microflora which adhere to the surface of the peat media.[5]

ITEM	DESCRIPTION
1	INLET
2	OUTLET PORT
3	#5 STONE
4	PEAT FIBER MEDIA
5	DISTRIBUTION ORIFICE
6	DISTRIBUTION GRID
7	VENT HOLES
8	ROPE HANDLE HOLES
9	STABILIZER BARS



Puraflo® Module, Typical

As shown, the Puraflo® Peat Fiber Biofilter and the Single Pass Sand Filter have similar performance characteristics. The media employed within the Puraflo® Peat Fiber Biofilter has some unique properties that enhance treatment and that are worth noting:

- ➔ Surface area...*52,000 ft²/ft³*
- ➔ Void space...*90-95%*
- ➔ Water holding capacity...*50-55%*
- ➔ Retention time...*36-48 hours*
- ➔ Cation Exchange Capacity (CEC)...*125 meq/g*

Patterson (2004)[6] outlines the roles identified above in the treatment process:

- ➔ **Physical properties - filtration** - the small particulate matter (usually high in BOD_5) that passes through the septic tank treatment is captured within the interstices of the peat fibre, and does not percolate through the peat with the drainage water. Thus, the loading of BOD_5 and TSS at the top of the peat can be significantly higher than the quality from average septic tanks.

- ➔ **Biological properties - microbial decomposition** – the peat fibres support a significant population of microbes which consume organic matter in the incoming primary treated effluent in much the same way as the zoogleal in a trickling filter consume the organic loading in a conventional sewage treatment works. In the peat system, the actual surface area of the peat fibres is many thousand times that of the trickling filter. This fact is borne out by the very high CEC of the peat that is a direct relationship with surface area. The 99.2% removal of FC without any external disinfecting agent indicates the efficacy of the peat as a disinfecting medium. The naturally high acidic properties of the peat also play a role in the disinfection process.

- ➔ **Biological properties - aerobic environment** - similar to an aerated wastewater treatment system, a highly developed population of aerobic bacteria is maintained within this environment. Laboratory results show that the peat can hold up to 300% of its own weight in water and maintain an air-filled capacity of more than 30% (about that of a soil at field capacity). This high aeration is confirmed by the ability of the peat to oxidise up to 96% of the ammonia-N in the STE.

- ➔ **Chemical properties** - the high CEC of the peat and its mineral content resulted in the changes to the cation ratios from the start of the trial to the end, reflected in the reduction in sodium adsorption ratio of the effluent in its transit through the peat. The loss of 74.6% of TP by adsorption is a highly significant reduction without further chemical additions. The reduction in salinity by 38% and the loss of 81.5% of alkalinity are further chemical changes induced by the peat environment. These losses are statistically significant.

Headley (2006)[7] describes some aspects of chemical and physical treatment:

- ➔ Peat can be described as partially fossilised plant matter which accumulates in wet areas (wetlands) where there is a lack of oxygen and the accumulation of the plant material is more rapid than its decomposition (Couillard, 1994; Viraraghaven, 1993). Peat is a porous, complex material containing lignin and cellulose as major constituents. These constituents contain polar functional groups, such as alcohols, aldehydes, ketones, acids, phenolic hydroxides, and ethers than can be involved in chemical bonding (Viraraghaven, 1993). This polar nature gives peat a high specific adsorption capacity for suspended and dissolved solids, such as transition metals and polar organic molecules. The particulate and highly porous nature of peat also makes it an effective physical filter (Perez et al. 2005). Studies have shown that partially decomposed peat has a relatively high porosity of approximately 95% and a specific surface area of 200 m2 per gram.

Kennedy (2000)[8] makes the following observation:

- Peat is an alternative filter medium for the treatment of various waste streams including septic tank effluent. The water holding capacity and adsorption capacity of peat make it a favorable filter medium over sand or gravel which are commonly used as the filter medium for the drainage field of septic systems.

4.0 SUMMARY

From the long history and wealth of studies done on Peat Biofilters it can be concluded that the treatment capability and performance is equivalent, or better, to a single pass sand filter.

Headley (2006)[9] offered the following comments and comparisons:

- Peat filters offer significant potential as a relatively passive, low-maintenance and robust secondary treatment device for on-site systems in the Gisborne region. Experience with peat filters internationally indicates that they are highly effective at removing TSS and BOD, and are more effective at removing pathogen indicators than similar fixed-bed filters using other media, such as sand or gravel. Peat filters have also been shown to be highly effective at nitrifying domestic wastewater, and in many cases are capable of removing 30-50% of the total nitrogen load.

- Field evaluations of peat filters used in on-site systems indicate that they are relatively robust under the typically variable loadings experienced in domestic situations (Patterson, 1999). They also represent a relatively low maintenance and passive treatment system, especially compared to package aerated wastewater treatment systems which generally require at least quarterly servicing by a trained technician. For example, Patterson (1999) reported that a domestic peat filter required only two hours of active maintenance in over 13 years of successful operation (1986-1999).

5.0 SYSTEM DESIGN & SPECIFICATION

The Puraflo® Peat Fiber Biofilter is a pre-engineered treatment system contained in factory pre-assembled molded polyethylene modules. It is a highly efficient system for the treatment of domestic strength wastewater and is designed to minimize site construction. Domestic quality primary effluent is evenly distributed over the specialized fibrous peat fiber media. One Biofilter module (approx. 7ft. long x 4.5 ft. wide x 2.5 ft. high) is designed to treat the wastewater from one bedroom, 2 people or a design flow of up to 150 gallons per day of domestic strength wastewater. Guideline hydraulic and organic loading rates per module are as follows:

- ➔ Maximum design organic loading per module 0.3755 lbs/d
- ➔ Maximum design hydraulic loading per module 150 gpd

5.1 System Configuration

The designer of a Puraflo® system will be responsible for proper configuration and sizing of the components of the system, pump and other peripheral component specifications, timer settings, and construction details.

5.2 Design Flow & # of Modules

Applicable regulations usually define the daily flow based on the number of bedrooms or the number of occupants with a defined flow per person per day. Bord na Móna research has determined that one module per bedroom or one module per 150 gallons is required to treat domestic strength wastewater.

5.3 Septic Tank

The size and configuration of the septic tank shall be in accordance with the NSF listing (as applicable) or State or Local requirements. The septic tank shall have a usable volumetric capacity of at least 24 hours retention. The septic tank, risers and lids must be watertight.

A commercial effluent filter with 1/32 inch filtration must be specified. Acceptable commercial effluent filters are the Bear Onsite ML3-932, Zabel A300, BEST GF10-32 and Polylok PL-625 (alternatively, the Sim/Tech Pressure Filter STF-100 may be used where it is not possible to install a gravity effluent filter). The effluent filter is installed on the septic tank outlet pipe to prevent grease and solids carryover into the pump tank.

5.4 Timed Dose Pump Tank

Dosing is typically regulated from a control panel with programmable timer, low water cut-off float switch and high water alarm. The low water cut-off switch should ensure that the pump remains covered at all times. There should be storage capacity above the high water alarm float equal to or greater than one quarter of the daily design flow. The flow equalization zone (between the low water cut-off and high water alarm floats) should be approximately half the daily flow to avoid nuisance alarm activity. A 750 to 1000 gallon pump tank is usually adequate for a typical 3 to 4 bedroom domestic application. A 500 gallon pump tank is the minimum. The size and configuration of the pump tank shall be in accordance with the NSF listing (as applicable) or State or Local requirements. The pump tank, risers and lids must be watertight.

The dosing volume should be approximately 7 to 15 gallons per module per cycle. For example, a 2 hour dosing interval for a 450 gpd three module system would result in 12 doses at 37.5 gallons per dose. This equates to 12.5 gallons per module per dose. If the force main is set up to drain back, the drain back volume should be factored into the dosing calculations. A sample pump tank drawdown test calculation is outlined in the table below.

Tank	
Gallons per inch	20.00
Design flow (gpd)	450
Drainback volume (gals)	25
# Puraflo® modules	3
# doses per day	12
Drawdown in tank (inches)	1.25
Time (seconds)	60
"ON" timer setting, secs	95
"ON" timer setting, mins	1.58
Dose volume per module	12.5

Table 5. Sample Drawdown Test Calculation

The diameter of the force main and Puraflo® outlet pipe manifold (where applicable) are typically 2 inches where between 1 and 6 modules are installed and 4 inches where 7 to 10 modules are installed.

Buoyancy calculations for the septic tank and pump tank should be performed when necessary.

5.5 Biofilter Modules

Effluent from the force main is distributed to the modules via a flow splitting manifold with pressure equalizing orifice plates. Effluent is distributed over the peat fiber media by a pre-installed rectangular grid with large diameter openings that prevent clogging. The effluent charges the grid using the velocity generated by the orifice plates. It is not a pressurized distribution grid.

The site specific design will detail the final effluent dispersal method. Effluent may be either discharged directly to a pad installation or may have a piped outlet for discharge to trench, pressure system, point discharge system or other effluent dispersal method, as applicable.

Modules are pre-assembled depending on the final effluent dispersal method and can have:

Pad system

- ➔ Weep-holes at the base for drainage to a pad system (Blue Module color code)
- ➔ Partial weep-holes with a piped outlet on the sealed end diverting effluent to a sample chamber (Green Module color code)

Other effluent dispersal methods

- ➔ Piped outlet for connection to another dispersal system (White Module color code)

It is important to specify which modules are needed for a particular design. The type of module is designated by a painted circle on the module lid.

Green module(s) adjacent to a sample chamber have half of their effluent piped from one end of the base of the module through the sample chamber, therefore, there are no weep holes on the end of the module feeding the sample chamber. The chamber essentially provides access to the sample pipes for performance testing purposes. Any uncollected effluent exits the sample chamber through holes in the base or side of the sample chamber.

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Models:

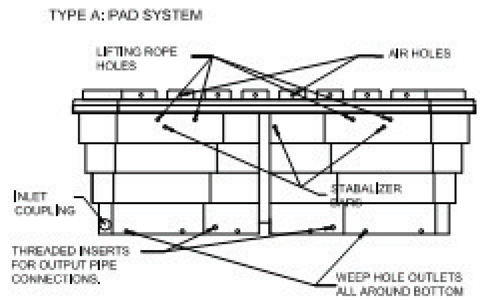
- ➔ Per table below as listed under NSF Standard 40. "A" denotes modules with weep holes around the base for discharge directly into a dispersal bed or trench. "B" denotes modules with a set of two, 1" threaded-ports at the base for connection to collection piping that can be routed to a drainfield or to a pump chamber or tank.
- ➔ Each module is painted on one corner of the lid with a color-coded triangle. Coding table and diagrams provided below.

NSF/ANSI STD 40 TREATMENT UNIT MODELS		
Model Number	Rated Capacity Gallons/Day	Classification
Puraflo Series		
P150N*3A	450	Class I
P150N*3B[1] [2]	450	Class I
P150N*4A	600	Class I
P150N*4B	600	Class I
P150N*5A	750	Class I
P150N*5B	750	Class I
P150N*6A	900	Class I
P150N*6B	900	Class I
P150N*7A	1050	Class I
P150N*7B	1050	Class I
P150N*8A	1200	Class I
P150N*8B	1200	Class I
P150N*9A	1350	Class I
P150N*9B	1350	Class I
P150N*10A	1500	Class I
P150N*10B	1500	Class I

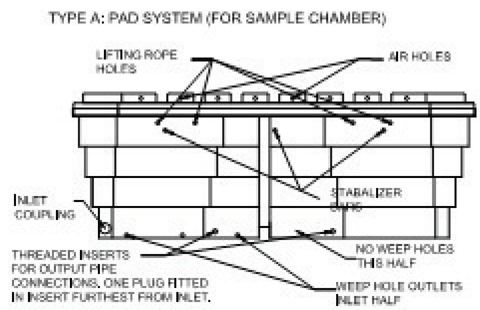
[1] Suffix 1 denotes a 1000 gallon pretreatment tank.

[2] Suffix 2 denotes a 1000 gallon pump tank.

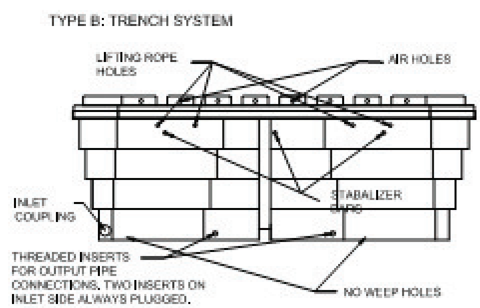
BLUE CODE MODULE



GREEN CODE MODULE



WHITE CODE MODULE



Module Color Coding

- White Coded Module: Closed bottom area, no holes in module.
- Blue Coded Module: (20) 7/8” dia. holes around basal area of module.
- Green Coded Module: (10) 7/8” dia. holes around half of module for sampling requirements.

5.6 Cold Weather Conditions

Certain precautions should be taken in extreme cold weather conditions. In particular, the force main should be designed to drain back after each cycle. Also, the module lids will come with foam insulation on the underside of the module lid. All systems must be verified for force main drain back and module lid insulation. Any other accepted standard practice for cold weather conditions should be used per State or Local requirements.

5.7 Life of the Peat Fiber Media

The effective life of the Puraflo® peat fiber media is estimated to be 15 years under the following conditions:

- ➔ System has been operated at or under design flow and loadings
- ➔ System has been designed and installed in accordance with Bord na Móna guidelines
- ➔ System has been maintained in accordance with Bord na Móna guidelines, been operated under and ongoing service contract and is in compliance with all Administrative Authority permit conditions

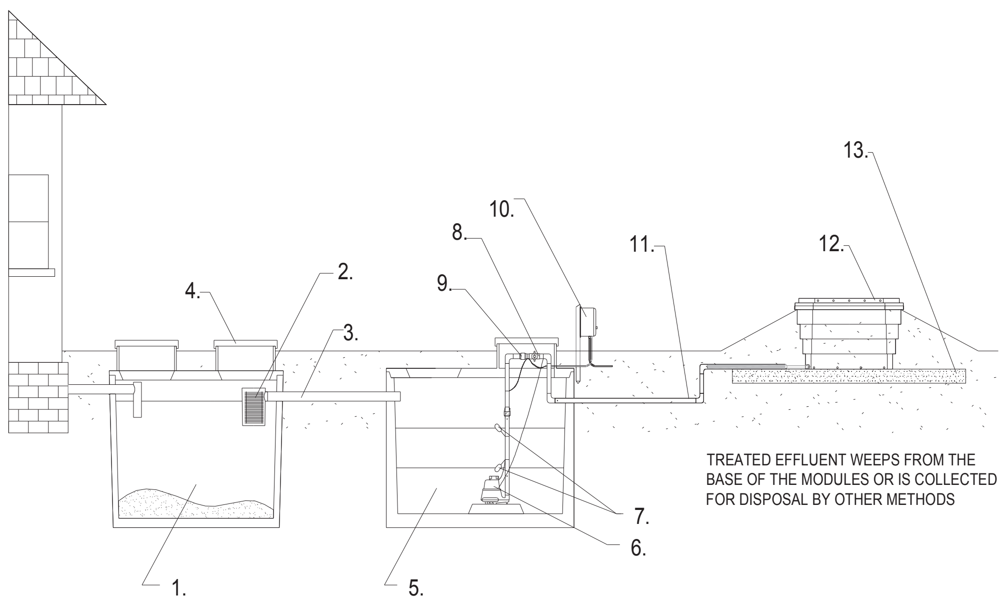
5.8 Final Dispersal System

The final dispersal system must be designed in accordance with State or Local regulations and Bord na Móna guidelines.

6.0 SYSTEM LAYOUT & COMPONENTS

6.1 Schematic of Puraflo® System Components

Part No.	Description	Part No.	Description
1	Septic Tank	8	Ball Valve
2	Effluent Filter	9	Union Disconnect
3	Sewer Line	10	Time Dose Control Panel
4	Riser and Lid	11	Force Main
5	Pump Tank	12	Puraflo® Module(s)
6	Pump	13	Stone Pad
7	Floats		



LIST OF PURAFLO SYSTEM COMPONENTS

6.2 Specification of Puraflo® Module

Max Treatment Capacity per Module	**150 gpd**
Module Length	**7’ 1”**
Module Height	**2’ 6”**
Module Width	**4’ 6”**
Module Weight	**≈1800 lbs**

7.0 INSTALLATION REQUIREMENTS

Installation of the Puraflo® system is straight forward and can usually be completed in less than a day.

- **Warning:** *Use recognized, safe lifting techniques to off-load and set modules. Ensure all lifting equipment is clear of overhead obstructions such a power lines, trees, rooftops or any other construction. Always be careful. Place the lifting equipment on solid, stable ground. Use a 4-point sling or equivalent (see below).*

Figure 2. Module Off-loading

The contractor/installer is required to provide the following:

- Mechanical excavator (backhoe) with operator.
- An electrician or person qualified to undertake the work in accordance with State or Local regulations (the electrician will be required to connect the pump and alarm to the control panel, set timer as required, and connect the control panel/junction box with the main power supply). Provide and supervise the installation of the underground cable from the control panel/junction box to the main circuit board.
- Provide gravity and force main piping and fittings per design. Piping under pressure must be PVC Schedule 40 or equivalent.
- Clean stone (3/4 to 1 inch) as required.
- Additional/imported fill material (typically not sand) and topsoil as required.
- Labor as necessary to install the system.
- Necessary supervision to ensure the system is installed per design.

8.0 ELECTRICAL REQUIREMENTS

An independent electrical circuit to power the control panel (115/230 volts and 20 amps typical) must be provided. These requirements may change by State or Local code or when a duplex panel, a larger pump or a high head pump is required per design. Please refer to site specific design to verify electrical requirements noting the requirement for 115 or 230 volts and the amps rating required for the controls and the pump.

9.0 SEQUENNTIAL INSTALLATION PROCEDURE

9.1 Site Clearance

- ➔ Clear site vegetation as required (minimize site disturbance).
- ➔ Provide sufficient access to proposed system.

9.2 Septic Tank

- ➔ Supply and install septic tank and sewer pipe from the dwelling in accordance with applicable State or Local regulations. The septic tank must be watertight against ground and/or surface water infiltration and exfiltration.
- ➔ Install septic tank on stable, compacted ground and backfill with suitable material as recommended by the manufacturer.
- ➔ Fit an effluent filter (1/32" specification) on the outlet pipe.
- ➔ Install water tight risers over inlet and outlet access ports to provide access for filter maintenance, septage removal, etc.
- ➔ Backfill and grade around the septic tank to prevent infiltration of surface water.
- ➔ See Appendix 1 - *Typical Septic Tank Detail.*

9.3 Pump Tank Installation

- ➔ Supply and install the pump tank in accordance with applicable State or Local regulations. The pump tank must be watertight against ground or surface water infiltration and/or exfiltration.
- ➔ Install pump tank on stable, compacted ground and backfill with suitable material as recommended by the manufacturer.
- ➔ Install gravity main from the septic tank to the pump tank in accordance with applicable State or Local regulations.
- ➔ Excavate a trench, typically 18 inches deep, from the pump tank to the location of the modules. In colder climates the force main may be buried deeper (below frost line).
- ➔ Place sufficient risers on top of the pump tank to reach slightly above grade level. It is extremely important to ensure a watertight seal between the pump tank and the first riser and between individual risers.
- ➔ All connections/seals should be made water tight in accordance with manufacturer's recommendations.
- ➔ Backfill, compact and landscape around the pump tank inlet/outlet pipes and electrical cable points of entry. Ensure suitable backfill material is used in accordance with manufacturers instructions.

9.4 Pump Fittings and Piping

- ➔ Place the base of the pump 4 to 6 inches above the base of the pump tank.
- ➔ Glue required length of PVC force main into the fitting at the outlet of the pump. Install the required fittings (check valve, union, ball valve, etc. as required by the design). Note: in most cases a 2 inch forced main is specified so a bushing ($1^1/_2$ inch x 2 inch) may be required to connect the internal pump tank piping to the pump. In some cases, the force main may be designed to drain back and a drain back hole will be required above the check valve. Install an air vent hole when required and an anti-siphon hole if the module grid is lower than the liquid level in the pump tank.
- ➔ Floats are generally used however other suitable level devices may be installed. Install on/off float typically at pump level (to ensure that the pump is kept submerged). Install alarm float with 1/2 day storage above the on/off float. Strap floats to force main or separate stand pipe or hang from bracket.

- ➔ Install the force main in the trench from the pump tank to the modules. Backfill trench once the line is correctly installed and connected. Be careful not to damage the installed force main line with heavy vehicle activity.
- ➔ See Appendix 1 - *Typical Pump Tank Detail.*

9.5 Puraflo® Installation

The site specific design will detail the final effluent dispersal method. Effluent may be either discharged directly to a pad installation or may have a piped outlet for discharge to trench, pressure systems, point discharge systems or other effluent dispersal methods, as applicable. The model numbers are identified as A for a pad installation and B for a piped outlet installation.

Type A - In-Ground Pad Installation

See Appendix 2 - *Type A: In-Ground Pad Configuration*

- ➔ Excavate a pad area (as specified in the design), making sure to maintain the required vertical separation distance between the bottom of the pad and any vertical restrictions such as seasonal high water table. The pad bottom must be level.
- ➔ Fill and level the excavated area with clean stone (3/4 to 1 inch, see Appendix 8) in accordance with the design, to a minimum depth of 6 inches.
- ➔ Position the modules on the stone pad area. Connect the force main to the module inlet coupling (incorporating a flexible pipe).
- ➔ Fit the sample chamber pipe to the outlet from the side of the green color coded module that does not have weep holes in the base. Insert the sample chamber pipe so that it extends 3 inches into the sample chamber and at least 5 inches off the base of the sample chamber. The sample chamber is pre-drilled with 3/4 inch holes in the base/side of the sample chamber to allow effluent to enter the pad foot-print area when samples are not being collected. The top of the sample chamber should be positioned at approximately the same level as the top of the modules.
- ➔ Backfill with stone around the modules to a height of 6 inches above the drain holes around the base of the modules when applicable.
- ➔ Cover the remaining exposed stone surface around the outside of modules with a suitable filter fabric. This prevents smaller soil particles from being washed into and subsequently clogging the foot-print area.
- ➔ Reinstate with suitable backfill and topsoil to finished design level.
- ➔ Ensure that the Puraflo® lids are securely fastened.

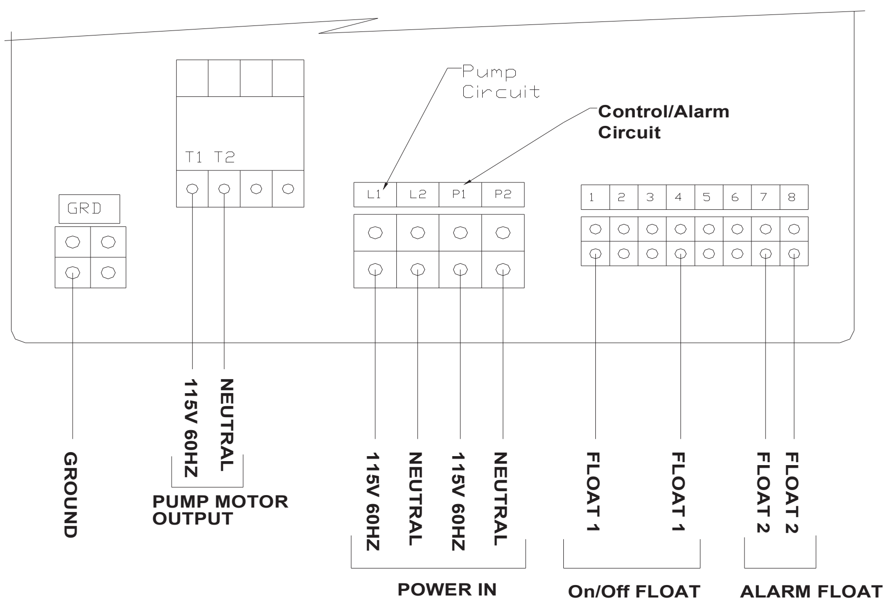
Type B – Piped Outlet Installation

See Appendix 2 - *Type B: Final Dispersal Separate from Module Configuration*

- ➔ For piped outlet installations the pad area's primary function is to level and support the modules.
- ➔ Excavate a pad area (as specified in the design). The pad bottom must be level.
- ➔ Fill and level the excavated area with clean stone (3/4 to 1 inch) in accordance with the design, to a minimum depth of 6 inches.
- ➔ Position the modules on the stone pad area. Connect the force main to the module inlet coupling (incorporating a flexible pipe). Construct the outlet pipework to the sampling chamber and to the final dispersal system in accordance with the design.
- ➔ Backfill with stone around the modules to a height of 6 inches above the drain holes around the base of the modules.
- ➔ Reinstate with suitable backfill and topsoil to finished design level.
- ➔ Ensure that the Puraflo® lids are securely fastened.

9.6 Electrical Connections

- ➔ Select a location for the electrical control panel near the pump tank or home.
- ➔ Install the cable between the power source and the control panel in accordance with State or Local regulations.
- ➔ Place the electrical power cable(s) in the trench/conduit (do not stretch cable). Connect each cable coming from the equipment in the pump tank in accordance with the wiring diagram located on the door of the control panel (a typical wiring schematic is detailed below). The cable between the pump tank and the control panel is to be installed in conduit and include the appropriate conduit seal. Reinstate area.
- ➔ Connect the electrical power cable(s) to an independent electrical power supply of the specified voltage (usually 115 volts), terminating in a socket or junction box protected by an M.C.B. as required (usually 20 amps). If a duplex control panel or high head pump is required the voltage and amperage requirements may increase.
- ➔ Input timer settings in accordance with design.
- ➔ Test and commission pump operation, start/stop conditions and alarms.
- ➔ All electrical work shall be done in accordance with State or Local regulations and/or building codes.



Typical Wiring Schematic for a simplex pump system. Please refer to the inside of the Control Panel for the actual wiring diagram and specifications.

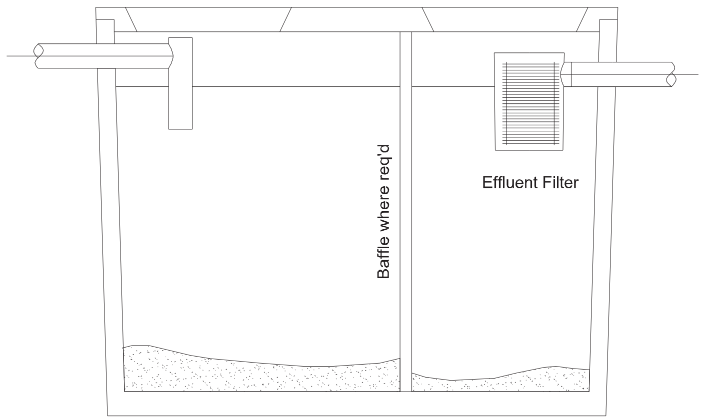
9.7 Spare Parts

Spare or replacement parts can be obtained from the manufacturer of the component or Bord na Móna if they need to be replaced.

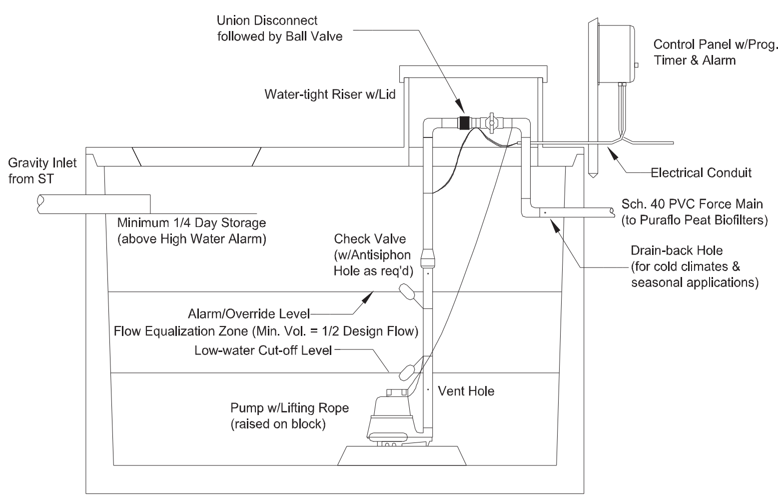
9.8 Site Restoration

- ➔ The modules must be installed at grade or above grade with the ground landscaped to divert storm water away from the modules.
- ➔ Backfill around modules to a height just under the lid of the modules. Grade the backfill back to the existing ground level on a slope no steeper than 2:1. Backfill should be suitable, loose, workable material. Compact backfill sufficiently to counteract settlement. Ensure a 6 inch minimum cover over drainfield stone where applicable. The final layer (6 inches) of fill material should be suitable topsoil capable of supporting vegetative growth.
- ➔ Grass seed and straw the sloped backfill area and any trench excavation lines with a suitable indigenous seed variety. In some cases, sodding for immediate stabilization may be specified.
- ➔ PROVIDE EROSION PROTECTION AS REQUIRED PER DESIGN PLAN.

APPENDIX 1 - TYPICAL SEPTIC TANK & PUMP TANK DETAIL



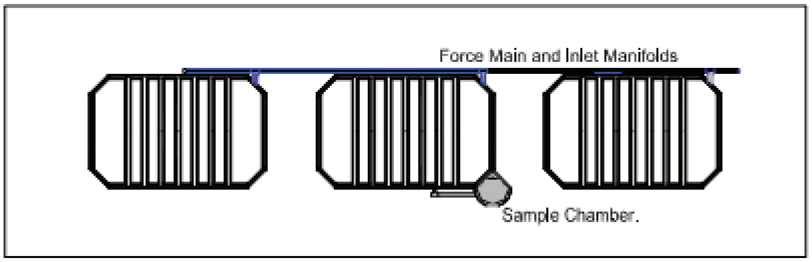
NOTES: 1. Septic tank must be approved by the State or Local regulatory authority.
2. Sizing, design, construction and installation must conform to applicable regulations.



NOTES: 1. Pump tank must be approved by the State or Local regulatory authority.
2. Sizing, design, construction and installation must conform to applicable regulations.

APPENDIX 2 - TYPE A & TYPE B INSTALLATION

TYPE A - PAD INSTALLATION.

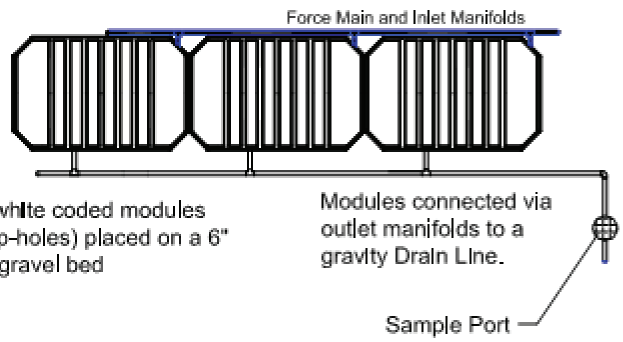


Blue coded modules with weep holes and one green coded module with sampling chamber, drain into a stone Pad for final treated effluent disposal.

Pad dimensions can be selected to match site conditions and modules can be installed side by side as well as end to end (as shown above)

NOTE: In-ground pad (trench) configuration.

TYPE B - PIPED OUTLET INSTALLATION.



Sealed white coded modules (no weep-holes) placed on a 6" support gravel bed

Modules connected via outlet manifolds to a gravity Drain Line.

The site specific design will detail the final effluent disposal method.

NOTE: Final dispersal separate from modules configuration.

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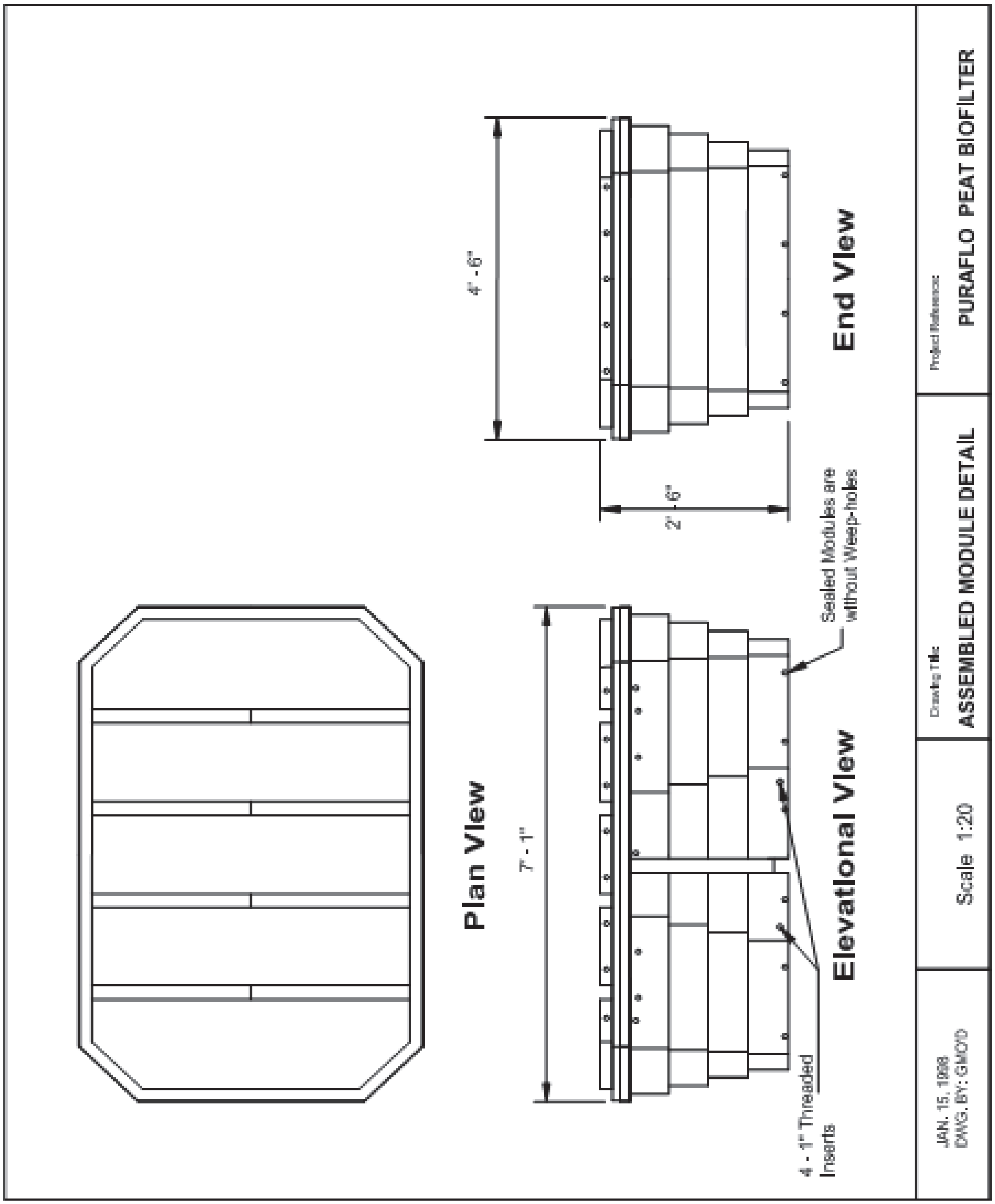
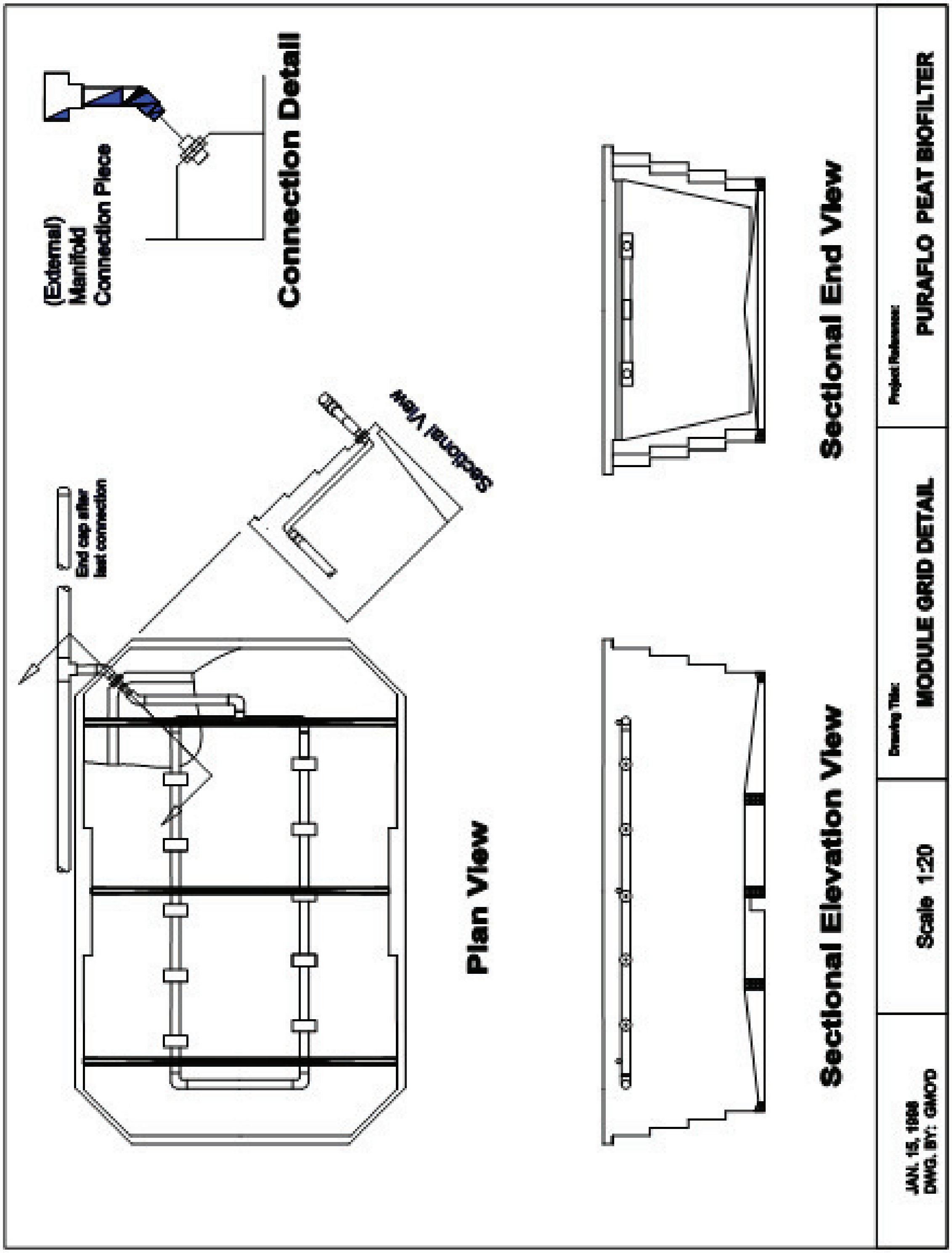
APPENDIX 3 - ASSEMBLED MODULE DETAIL



APPENDIX 4 - MODULE GRID DETAIL

NOTE: ALL PIPING AND FITTINGS MUST BE A MINIMUM SCH. 40 RATED.



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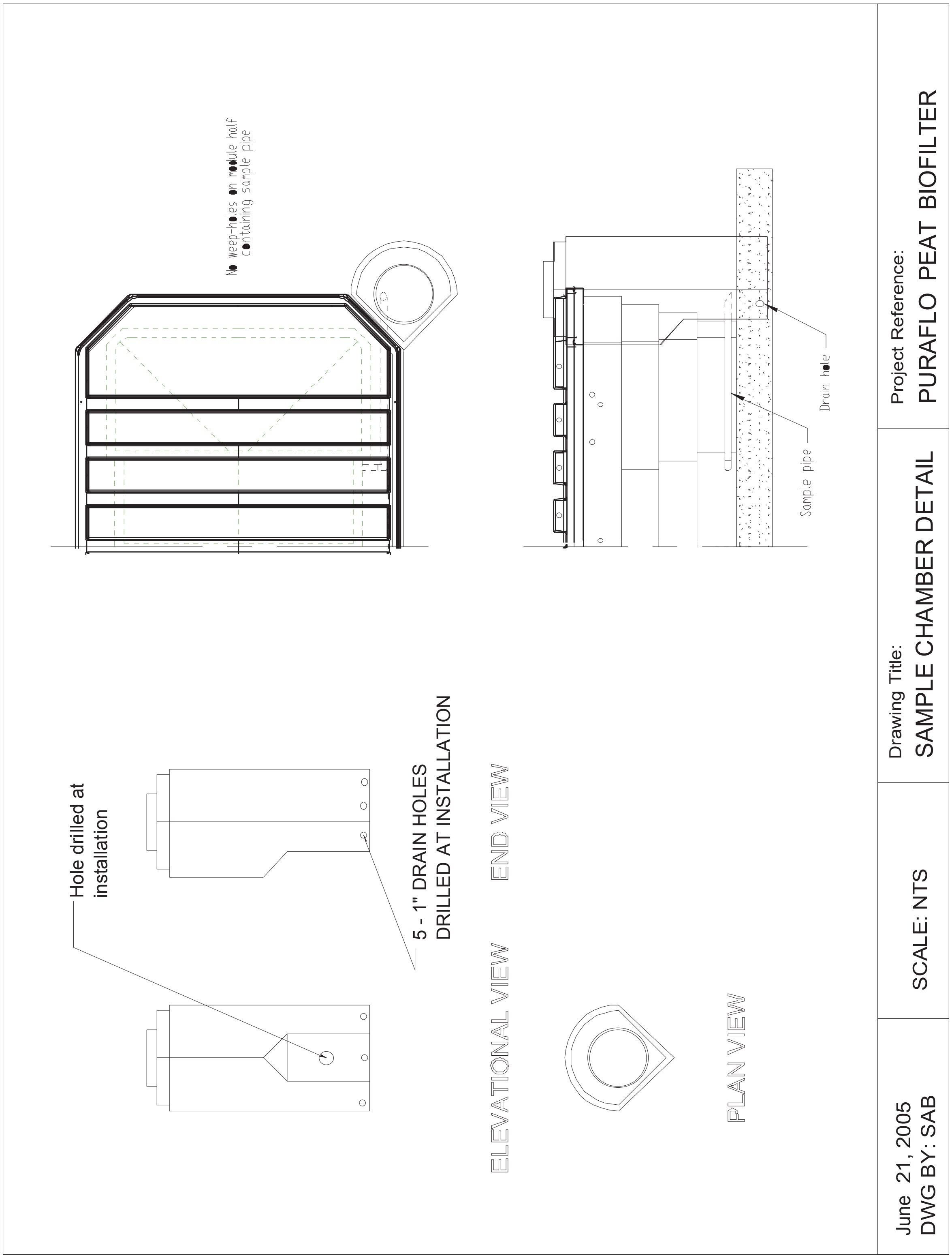
APPENDIX 5 - SAMPLE CHAMBER DETAIL

NOTE: ALL PIPING AND FITTINGS MUST BE A MINIMUM SCH. 40 RATED.

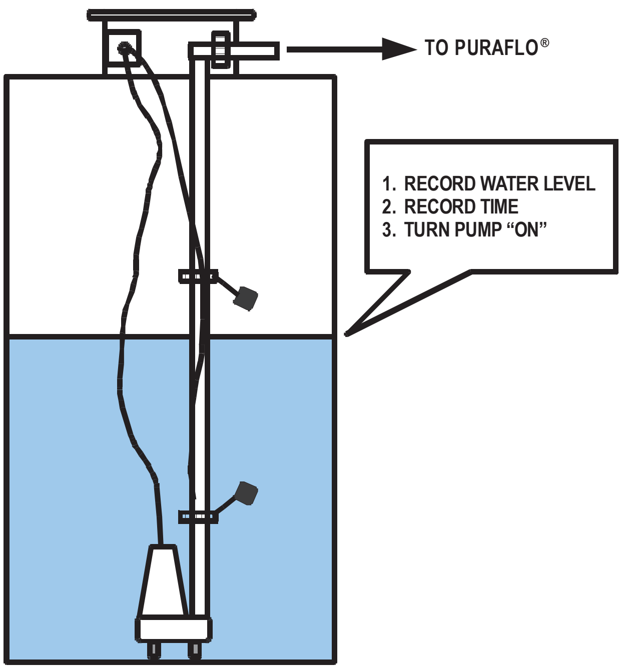


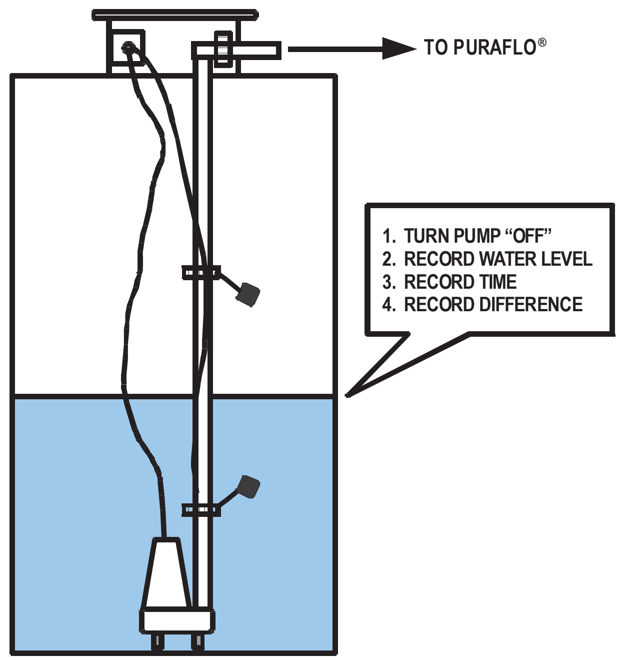
APPENDIX 6 - MODULE PICTURES

APPENDIX 7 - INFORMATION NEEDED FOR THE DRAWDOWN TEST

- ✔ Pump tank gallons per inch
- ✔ Design flow (gallons per day)
- ✔ Drainback volume (gallons), if applicable for cold weather situations
- ✔ # of Puraflo modules
- ✔ # of doses per day (typically 12)

Drawdown Test Procedures





Step 1

- ✔ Record water level
- ✔ Record time
- ✔ Turn pump "on"

Step 2

- ✔ Turn pump "off"
- ✔ Record water level
- ✔ Record time
- ✔ Record water level difference & elapsed time

Timer Setting & Module Dose Volume Based on Drawdown Test

Example Parameters

✔ Pump tank gallons per inch	*20 gallons*
✔ Design flow	*450 gpd (3 bedroom home)*
✔ Drainback volume, per dose	*5 gallons*
✔ # of Puraflo modules	*3 modules*
✔ # of doses per day	*12 doses*
✔ Water level difference	*2 inches*
✔ Elapsed time	*1 minute*

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Example Timer Setting - Step 1

Multiple *Drainback volume, per dose* by *# of doses per day*

5 gallons x 12 doses = **60**

Example Timer Setting - Step 2

Add *Design flow* & *Total from Step 1*

450 gallons + 60 gallons = **510**

Example Timer Setting - Step 3

Divide the *Total from Step 2* by *# of doses per day*

510 ÷ 12 doses = **42.5**

Example Timer Setting - Step 4

Multiply the *Total from Step 3* by *Elapsed time*

42.5 x 1 minute = **42.5**

Example Timer Setting - Step 5

Multiply the *Pump tank gallons per inch* by the *Water level difference*

20 gallons per inch x 2 inches = **40**

Example Timer Setting - Step 6

Divide the *Total from Step 4* by the *Total from Step 5*

42.5 ÷ 40 = **1.06 minutes**

1.06 minutes for "on" timer setting *or*
1.06 minutes x 60 seconds/minute = **63.6 seconds (round-up to 64 seconds)**

Example Timer Setting - Step 7

Divide the *Hours in a day* by the *# of doses per day*

24 hours ÷ 12 doses = **2 hours for "off" timer setting**

Example Module Dose Volume - Step 1

Divide the *Design flow* by the *# of doses per day*

450 ÷ 12 = **37.5**

Example Module Dose Volume - Step 2

Divide the *Total from Step 1* by the *# of Puraflo® modules*

37.5 ÷ 3 = 12.5 gallons per dose per Puraflo® module

APPENDIX 8 - WISCONSIN DESIGN & INSTALLATION CRITERIA

Type A System - Puraflo® Modules Combined with IN-GROUND PAD Dispersal

- ➔ Refer to section 5 and 9 of this manual.
- ➔ All components used in conjunction with the Puraflo® Peat Fiber Biofilter must comply with all applicable Wisconsin rules and codes.
- ➔ The septic tank shall be sized according to the NSF testing criteria, which can be figured by dividing the daily design flow by 0.9 or according to state or local code.
- ➔ An effluent filter/screen shall be placed on the outlet of the septic tank that meets the requirements of Section 5.3 of this manual.
- ➔ The pump tank shall be sized according to the NSF testing criteria, which can be figured by dividing the daily design flow by 0.9 or according to state or local code.
- ➔ The following requirements apply to the design and installation of a Puraflo® Type A in-ground pad system.
  - (1) All designers and installers of the Type A pad system shall be certified by the Bord na Móna or a Bord na Móna authorized representative.
  - (2) Calculations can be done with the Microsoft Excel Wisconsin Design Sheet.
  - (3) The Type A pad system area shall be sized according to ≤30 mg/l BOD_5 criteria in Comm 83.44.
  - (4) The bottom of the rock dispersal area shall maintain a minimum vertical separation distance of 1 foot from limiting conditions. In situ soil must comply with Comm 83.44.
  - (5) Location must be comply with Table 83.43-1.
  - (6) The dispersal aggregate shall be clean stone (3/4 to 1 inch). The stone shall be washed with not more than 5% passing the No. 200 (75 µm) sieve as determined by ASTM C117, “Test Method for Material Finer than 75-µm (No. 200) Sieve in Mineral Aggregates by Washing” and shall be durable with a hardness of 3 or greater on the Moh’s Scale of Hardness.
  - (7) The dispersal material shall be leveled to a depth of 6 inches.
  - (8) The Puraflo® modules shall be placed on the dispersal material so that they are evenly spaced from the sides of the distribution bed and end of the distribution bed with even spaces between each module and the ends of the dispersal area. The minimum spacing from the end of the dispersal material to module end is 1 foot. For spacing calculation, see example below. The modules shall consist of one green coded module and the remainder blue coded (modules may be shipped from the factory as white coded that can be field modified to blue or green by drilling the appropriate number of 5/8” holes on predetermined spots on the modules). If modules are field modified it is the responsibility of the installer to change the color code on the lid of the module.

Sample spacing calculation

3 modules, each module is 4.58'W x 7.08'L
Dispersal pad is 10'W x 96'L

Total module L = 3 x 7.08' = 21.24'
Spacing between modules & ends = 96' - 21.24' = 74.76'
=74.76' / 2 (in-between modules) + 2 (ends) = 74.76' / 4
= *18.69' between modules & from ends*

  - (9) The Puraflo® modules shall be level from side-to-side and end-to-end.
  - (10) Connect the force main to the module inlet coupling (incorporating a flexible pipe). Note sizing requirements in section 3.4 of this guide. The manifold connection shall be configured

like the illustration in Appendix 2 and 4 of this guide and shall pass the last module by a minimum of six Inches and be capped. It is recommended that a clean-out be brought to finished grade.

(11) Distribution media shall be placed at a level to completely cover the distribution holes on the side bottom of the Puraflo® modules.

(12) A Bord Na Móna specified sample chamber shall be placed on one of the outlet connections of a green color coded module for sampling of effluent.

(13) Once the Puraflo® modules are installed and all connections have been made, the distribution media shall be covered with a geotextile fabric.

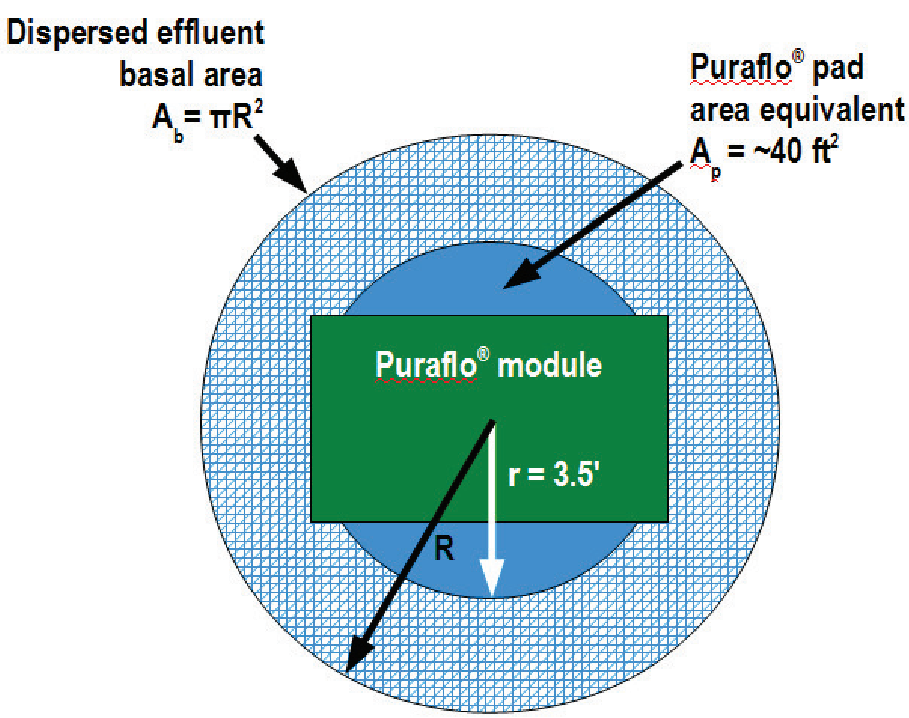
(14) The system shall be backfilled with sandy to loamy soil material and topsoil to the bottom lip of the Puraflo® modules.

(15) Additional design considerations:

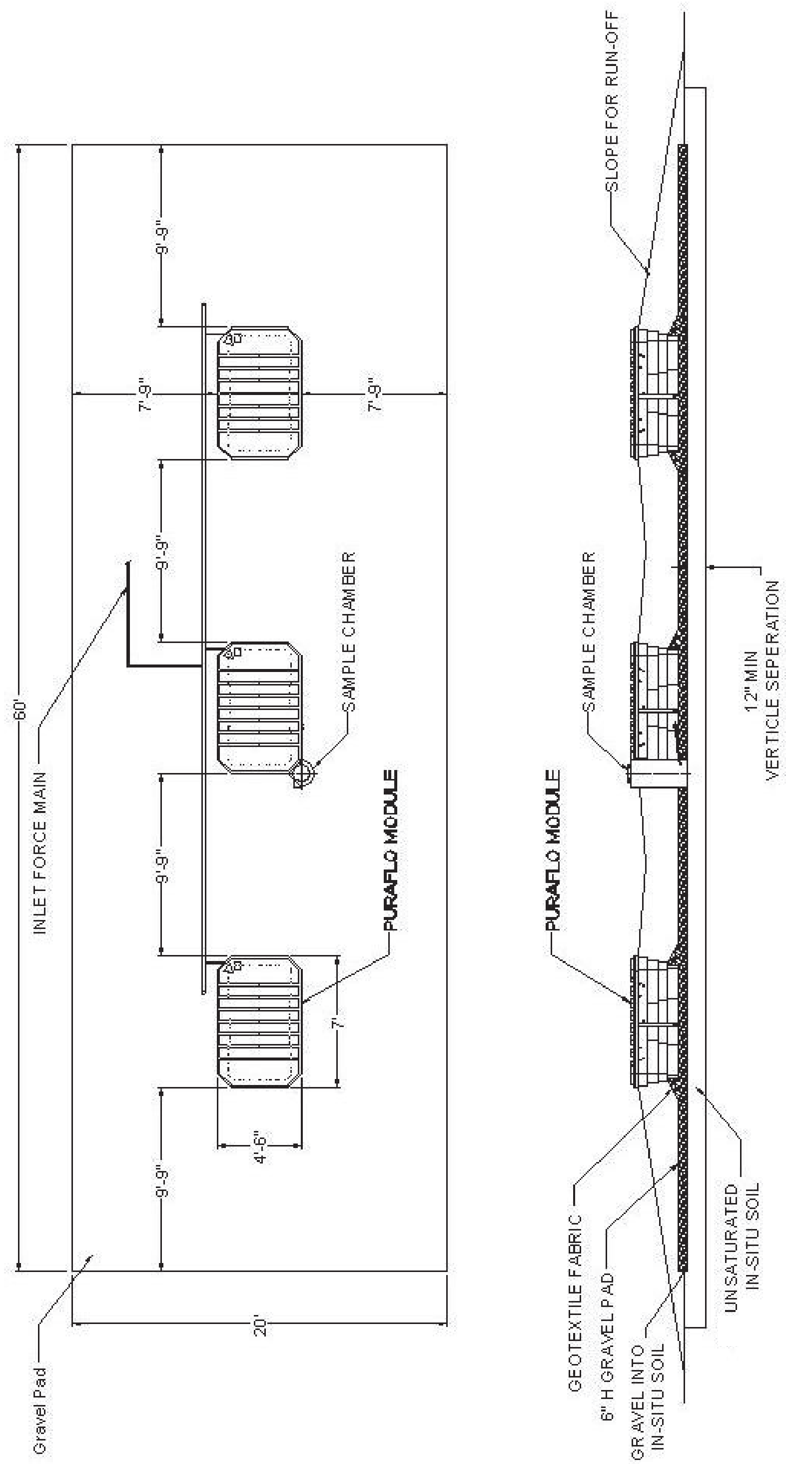
For slowly permeable soils, designers must use professional judgment to ensure effluent absorption into the soil and that other potential issues are mitigated, such as water mounding. For most soils, absorption and water mounding are not issues, even with as little as 1 foot of minimum vertical separation. Also, Converse and Tyler (2000)[10] note, *"The design loading rates are based on 150 gpd/bedroom resulting in 450 gpd for a 3 bedroom home. If the mound, as well as other soil based units, is loaded at 450 gpd on a regular basis, it will likely fail (emphasis added). The daily average flow is expected to be no more than about 60% of design or 270 gpd."*

The dispersal area beneath the Puraflo® module can be converted to a circular area. The effluent spread, as depicted in the diagram below, and water mounding height can then be calculated using the Kaplan (1991)[11] equations below.

$$R=\sqrt{Q/\pi k'}$$
$$H=\sqrt{Q^2/2kk'}$$



IN-GROUND PAD SYSTEM DIAGRAM (TYPICAL)



Type A System - Puraflo® Modules Combined with MOUNDED PAD Dispersal

CONDITIONS
- Refer to section 5 and 9 of this manual.
- All components used in conjunction with the Puraflo® Peat Fiber Biofilter must comply with all applicable Wisconsin rules and codes.
- The septic tank shall be sized according to the NSF testing criteria, which can be figured by dividing the daily design flow by 0.9 or according to state or local code.
- An effluent filter/screen shall be placed on the outlet of the septic tank that meets the requirements of Section 5.3 of this manual.
- The pump tank shall be sized according to the NSF testing criteria, which can be figured by dividing the daily design flow by 0.9 or according to state or local code.
- All designers and installers of the Type A pad system shall be certified by the Bord na Móna or a Bord na Móna authorized representative.
- Calculations can be done with the Microsoft Excel Wisconsin Design Sheet.
- The bottom of the rock dispersal area shall maintain a minimum vertical separation distance of 1 foot from limiting conditions. In situ soil must be a minimum of 6 inches.

SITE LIMITATIONS & MODIFICATIONS
- Mounded pads shall be oriented parallel to natural surface contours and shall be sited to avoid natural drainage features and depressions that may hold surface water. A design plan shall address surface water diversion as needed.
- An interceptor drain may be used upslope of a mounded pad soil absorption component to intercept the horizontal flow of subsurface water to reduce its impact on the down gradient mounded pad component.
- A mounded pad soil absorption component shall not be sited on a slope greater than fifteen percent unless the design plan includes special installation criteria.
- Sites with boulders or numerous trees are less desirable for a mounded pad soil absorption component. Such conditions shall be avoided or the design plan shall increase the basal area to compensate for losses due to boulders or flush cut trees and shall include special instructions for the basal area preparation under such conditions.

SITE & SOIL INFORMATION
- Site information shall include a description of landscape position, slope, vegetation, drainage features, rock outcrops, erosion and other natural features; and documentation of any relevant surface hydrology, geologic and hydrogeologic risk factors for the specific site or in the surrounding area that may indicate vulnerability for surface water and ground water contamination.
- Soil Information shall include identification of depth to limiting conditions including but not limited to water table and rock strata, and a description of soil texture, consistence, and structure, including shape and grade.

DESIGN CRITERIA
- The Type A mounded pad system area shall be sized according to ≤30 mg/l BOD_5 criteria in Comm 83.44. The Type A mounded pad system linear loading rate shall not exceed 4.5 gal/ft/day for systems with in situ soils having a soil application rate of ≤0.3 gal/ft^2/day within 12 inches of fill material.
- Location must be comply with Table 83.43-1.

SAND FILL
- The mounded pad sand fill depth shall be determined based on the depth to the limiting conditions. The sand fill depth shall not exceed two feet and shall not be less than four inches. The loading rate for the sand fill material shall not exceed 2.0 gpd/ft^2.
- Natural sand is defined as naturally deposited silica based sand not manufactured by mechanical processing such as the crushing of rock or coarse aggregates.

- ➔ Sand fill for the mounded pad must be concrete sand meeting the gradation requirements of ASTM C33 provided not more than 5% passes the No. 100 sieve and not more than 5% passes the No. 200 sieve as determined by ASTM C117, “Test Method for Material Finer than 75-µm (No. 200) Sieve in Mineral Aggregates by Washing”.
- ➔ A comparison of sand application rates from various regulatory authorities is in the table below.

REGULATORY AUTHORITY	GRADATION	ADDNL GRADATION REQUIREMENTS	EFFECTIVE SIZE	UNIFORMITY COEFFICIENT	SAND APPLICATION RATE GPD/FT² (≤30 mg/l BOD_5)
Iowa	ASTM C33 or IDOT No.1	Sand fill must not have more than 20% (by weight) material that is greater than 2mm in diameter (coarse fragments), which includes stone, cobbles and gravel. Also, there must not be more than 3% silt and clay (<0.53 mm, 270 mesh sieve) in the fill.	0.15 – 0.3mm	4 – 6	2.0
Minnesota	ASTM C33	No spec for No. 100 sieve. No. 200 sieve 0-5% passing. Clean sand must also contain less than three percent deleterious substances and be free of organic impurities.	None Specified	None Specified	1.6
Washington	ASTM C33	No. 100 sieve prefer <4% passing. No. 200 sieve 0-3% passing.	None Specified	None Specified	2.0
Wisconsin	ASTM C33	None Specified	None Specified	None Specified	2.0
British Columbia	ASTM C33	No. 100 sieve 0-4% passing. No. 200 sieve 0-1% passing.	None Specified	None Specified	1.6 to 3.15
Manitoba	CSA A23.1 (ASTM C33)	No. 200 sieve 0-5% passing.	None Specified	None Specified	1.6 to 3.75

DISTRIBUTION AREA OVER SAND FILL

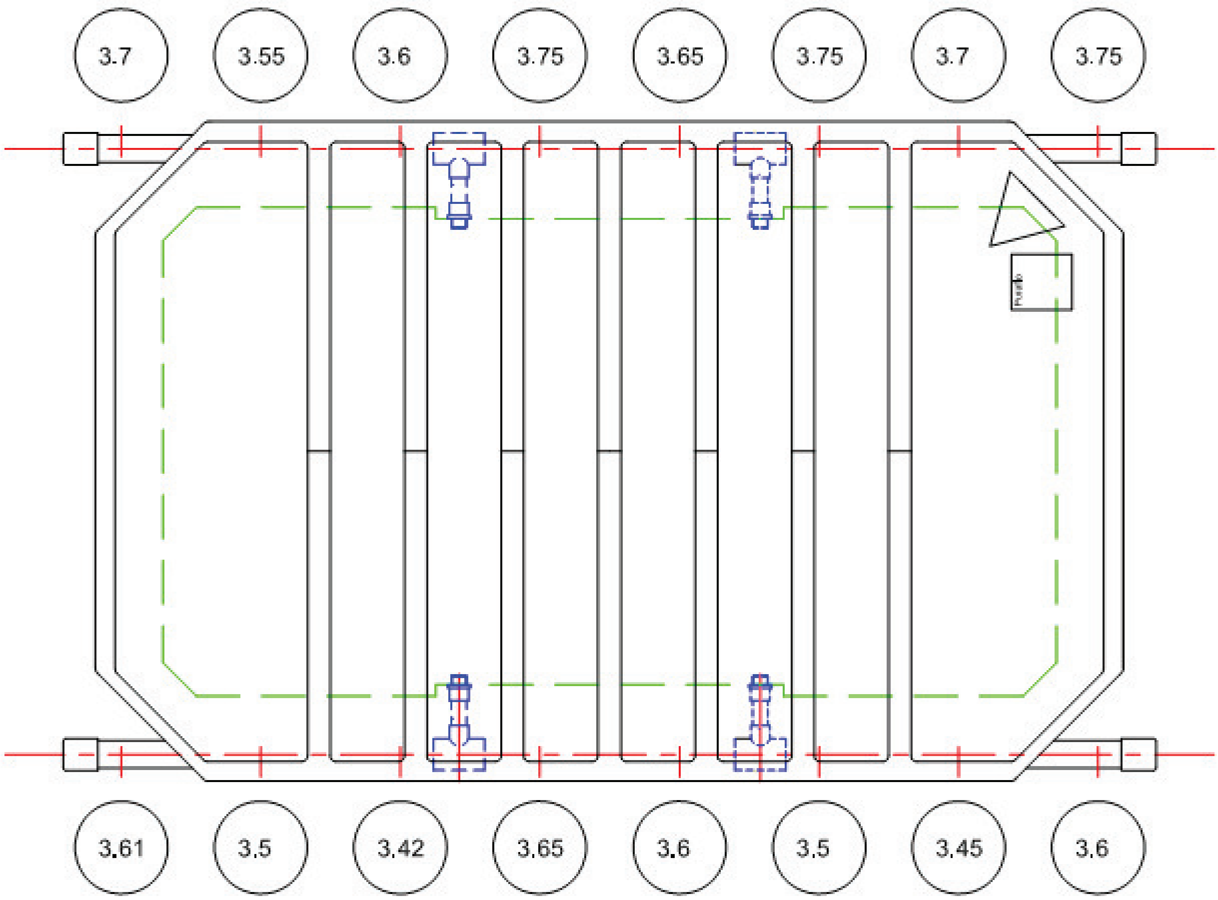
- ➔ The dispersal aggregate shall be clean stone (3/4 to 1 inch). The stone shall be washed with not more than 5% passing the No. 200 (75 µm) sieve as determined by ASTM C117, “Test Method for Material Finer than 75-µm (No. 200) Sieve in Mineral Aggregates by Washing” and shall be durable with a hardness of 3 or greater on the Moh’s Scale of Hardness. Plans may specify the use of other distribution area products or material such as gravelless and chamber products.
- ➔ The dispersal material shall be leveled to a depth of 6 inches.
- ➔ The Puraflo® modules shall be placed on the dispersal material so that they are evenly spaced from the sides of the distribution bed and end of the distribution bed with even spaces between each module and the ends of the dispersal area. The minimum spacing from the end of the dispersal material to module end is 1 foot. For spacing calculation, see "Mounded Pad Design Example".
- ➔ The Puraflo® modules shall be level from end-to-end.
- ➔ Connect the force main to the module inlet coupling (incorporating a flexible pipe). Note sizing requirements in section 3.4 of this guide. The manifold connection shall be configured like the illustration in Appendix 2 and 4 of this guide and shall pass the last module by a minimum of six Inches and be capped. It is recommended that a clean-out be brought to finished grade.

DISTRIBUTION NETWORK

- ➔ The distribution network must be 2 inch PVC pipe with 3/8 inch orifices spaced between one to three feet. The orifices should be oriented in the 9 o'clock position.
- ➔ Each module must have an isolated lateral with clean-out brought to finished grade on each distal end.
- ➔ Each individual distribution lateral must be level within 1/4 inch +/- from module drain hole to lateral end.

- Testing was conducted by Bord na Móna to demonstrate the ability of the network to reasonably provided uniform distribution. Test results conducted on the network are shown in the diagram below (Each circle represents a collection bucket below a 3/8 inch orifice.)

DOSE VOLUME = 60 Liters



MONITORING COMPONENTS

- At least three inspection ports shall be spaced at intervals adequate for observation of the absorption area and any ponding at the sand fill surface. The ports shall be anchored and be accessible with at least a four inch opening and a removable watertight cap.
- Each module must have an isolated lateral with clean-out brought to finished grade on each distal end for flushing-out any materials, such as peat particles migrating to the lateral during initial operation of the system.

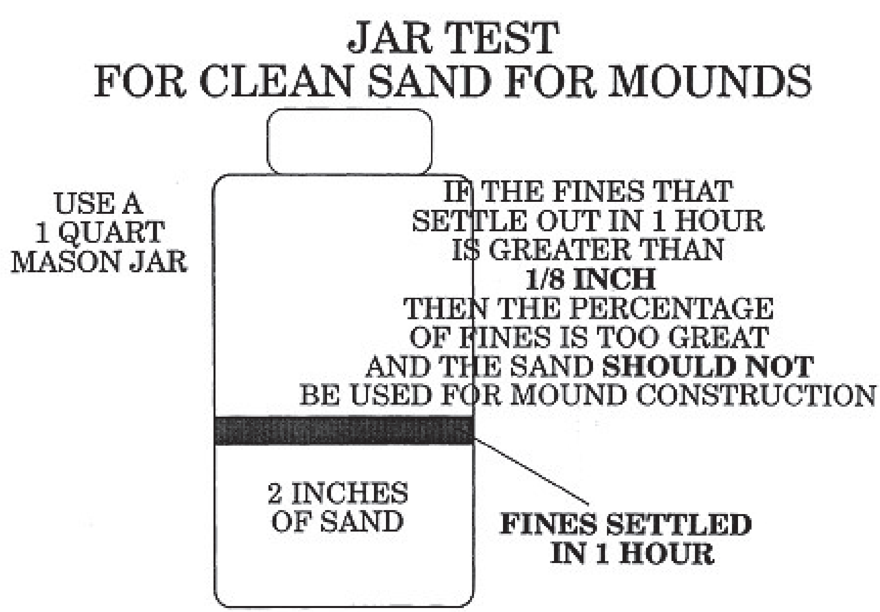
MOUND COVER

- Once the Puraflo® modules are installed and all connections have been made, the distribution media shall be covered with a geotextile fabric used to prevent introduction of soil fines and allow for free movement of air and water.
- The soil cover shall be applied to allow for an approximate depth of six inches after settling, and the mounded pad shall be crowned to promote runoff.
- Soil cover shall be of a quality to allow for oxygen transfer and growth of vegetation.

INSTALLATION

- **Pre-Installation** - The full soil absorption area shall be free of any site disturbances. If any disturbance or damage has occurred, installation shall not proceed and the registered installer shall contact the owner and the board of health. Prior to installation the registered installer shall check all elevations in the design plan relative to the established benchmark including the surface contour and the flow line elevation of other components to assure proper flow through the system and freeze protection as applicable. Soil moisture conditions shall be evaluated and basal area preparation shall not proceed when there is risk of smearing or compaction.
- **Site Preparation & Installation** - The mound shall be installed according to the design manual and any referenced resource and shall comply with the following:
  - (1) All vegetation shall be cut close to the ground and removed from the site. Stumps, roots, sod, topsoil, and boulders shall not be removed.
  - (2) The force main should be installed from the upslope side. All vehicle traffic on the basal area and downslope area of the mounded pad should be avoided with installation work being conducted from the upslope side or end of the mounded pad basal area.
  - (3) The basal area of the mounded pad shall be prepared to provide a sand/soil interface and to improve infiltration if needed. The basal area preparation shall not reduce the infiltrative capacity of the soil surface. The degree of basal area preparation shall be determined on a site by site basis depending on soil conditions. Any basal scarification or other basal area preparation shall be conducted working along the contour. Sand may be incorporated into the basal area during the preparation process. Following basal preparation, a layer of sand fill shall be placed on the entire basal area to prevent damage from precipitation and foot traffic.
  - (4) The specified depth and sufficient amount of sand fill shall be placed to cover the basal area, form the absorption area, and shall not be steeper than 3 to 1 side slopes. The distribution area shall be formed to the specified dimensions and the sand surface of the distribution area shall be level.
  - (5) Construct and install all components, including the distribution laterals and observation ports.
  - (6) Once the Puraflo® modules are installed and all connections have been made, the distribution media shall be covered with a geotextile fabric.
  - (7) Field test the sand to verify quality with one of the methods outlined below.

    Minnesota Method (from 1995 University of Minnesota "Onsite Sewage Treatment Manual")



Manitoba Method (from OWMS Jar Test revised April, 2010)

OWMS – Field Reference Guide
JAR TEST

Under some circumstances, it may be beneficial to perform a jar test for fines (silt or clay) on the sand when it is received or before it is purchased to determine if the sand supplied meets the specification of the sand ordered.

An **8 hour jar test** must be conducted for best results.

The jar test is a 'quick' method to determine if the sand contains too many fines. The jar test is not to be used as a replacement for sieve analysis; however the test can be used as a field method to determine that the sand meets CSA A23.1-04 (ASTM C33) specifications.

After settling for several hours, if the layer of fines that settle on top of the sand is thicker than 3.2 mm (1/8 inch), the sand contains too many fines and is not suitable for use in a treatment mound. When in doubt the aggregate supplier should provide an aggregate analysis report to confirm that the product meets the sieve specification.

When a 'check' on the sand is required, it is recommended that a sample of the sand be obtained prior to construction and the 8 hour jar test be conducted.

Jar test procedure is as follows:

- Place approximately 2 inches of sand in a glass quart jar.
- Fill the jar with water.
- Shake the jar vigorously to mix the sand and water.
- Set the jar on a level platform and allow to settle for several hours (4 - 8 hours).
- Upon settling, after several hours (4 - 8 hours), the layer of fines that settle on top of the sand layer should not be thicker than 3.2 mm (1/8 inch).

TIPS:*
Take a sample from the middle of the pile.
It may be necessary to jar test a composite sample.
It may be necessary to conduct two jar tests.
When in doubt, obtain the sieve analysis report from the aggregate supplier or send a sample to the laboratory. Be sure to ask the laboratory to include the No. 200 sieve size.

➔ **Completion**

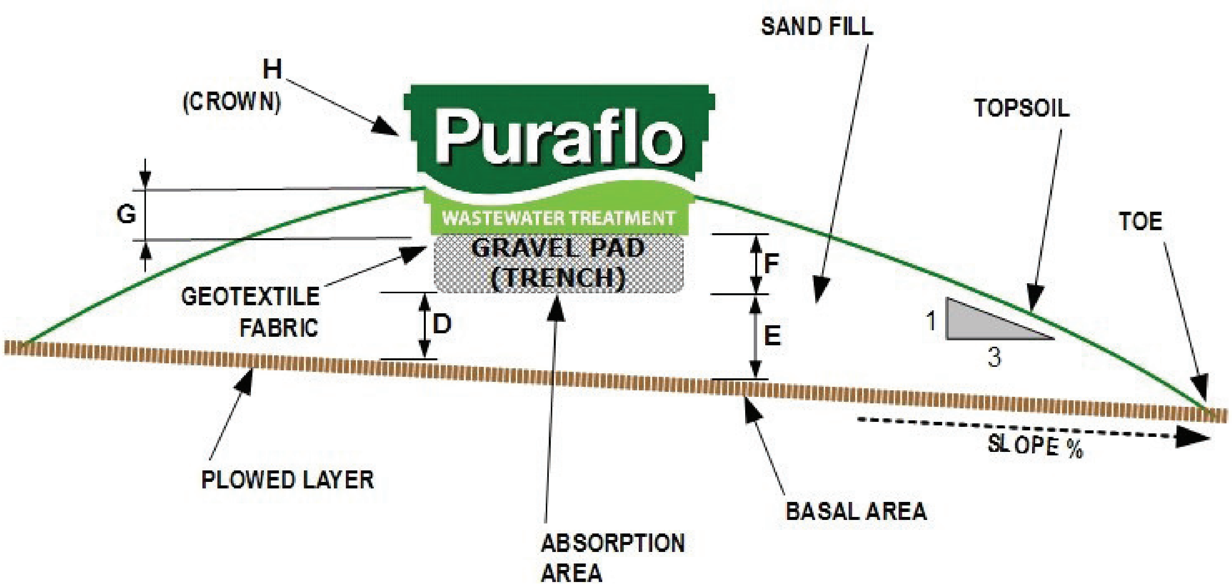
(1) The area around the mound system shall be protected from erosion through upslope surface water diversion and provision of suitable vegetative cover, mulching, or other specified means of protection.
(2) Installer documentation shall include the drawdown test, as specified in Appendix 7, as baseline measure for future O&M and monitoring. Documentation shall be provided to the local health district to be included in the permit record.
(3) The system shall be backfilled with sandy to loamy soil material and topsoil to the bottom lip of the Puraflo® modules.

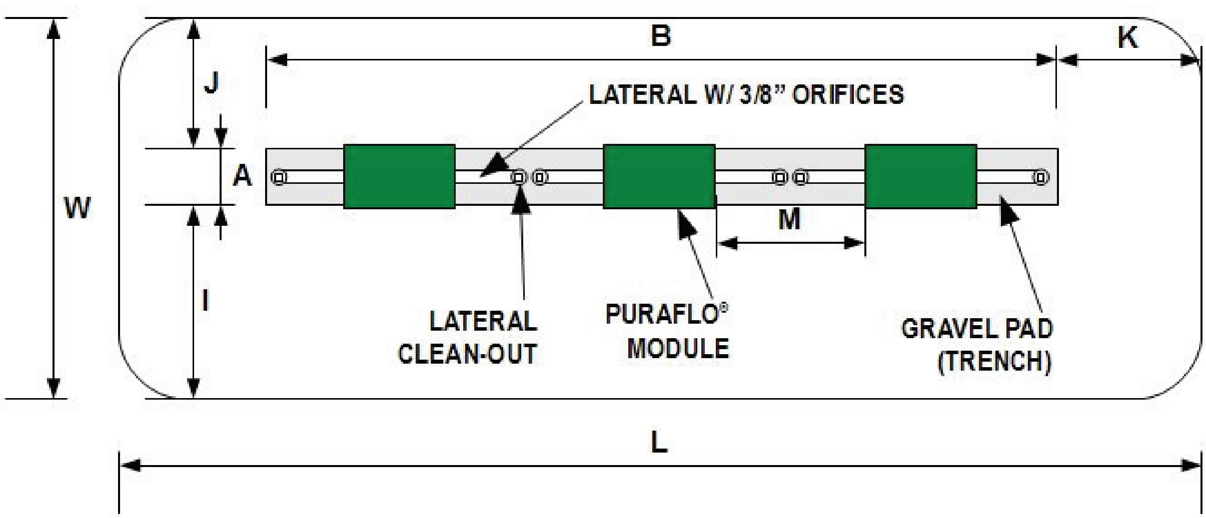
OPERATION & MAINTENANCE

➔ The mounded pad system shall be operated, maintained, and monitored as outlined in the "Operation & Maintenance Manual" and per requirements of the regulatory authority.
➔ The O&M of a mound soil absorption system shall include but is not limited to:

(1) Checking the mounded pad vegetative cover for erosion or settling and any evidence of seepage on the sides or toes of the mounded pad.
(2) Flushing of distribution laterals.
(3) Checking for ponding in the distribution area.
(4) Monitoring the dose volume to the Puraflo® modules and performing the drawdown test as outlined in Appendix 7.
(5) Checking for any surface water infiltration or clear water flows from the dwelling or structures into the system components or around the mounded pad soil absorption area.

MOUNDED PAD SYSTEM DIAGRAMS (TYPICAL)





Note: A mounded pad soil absorption component shall not be sited on a slope greater than fifteen percent unless the design plan includes special installation criteria.

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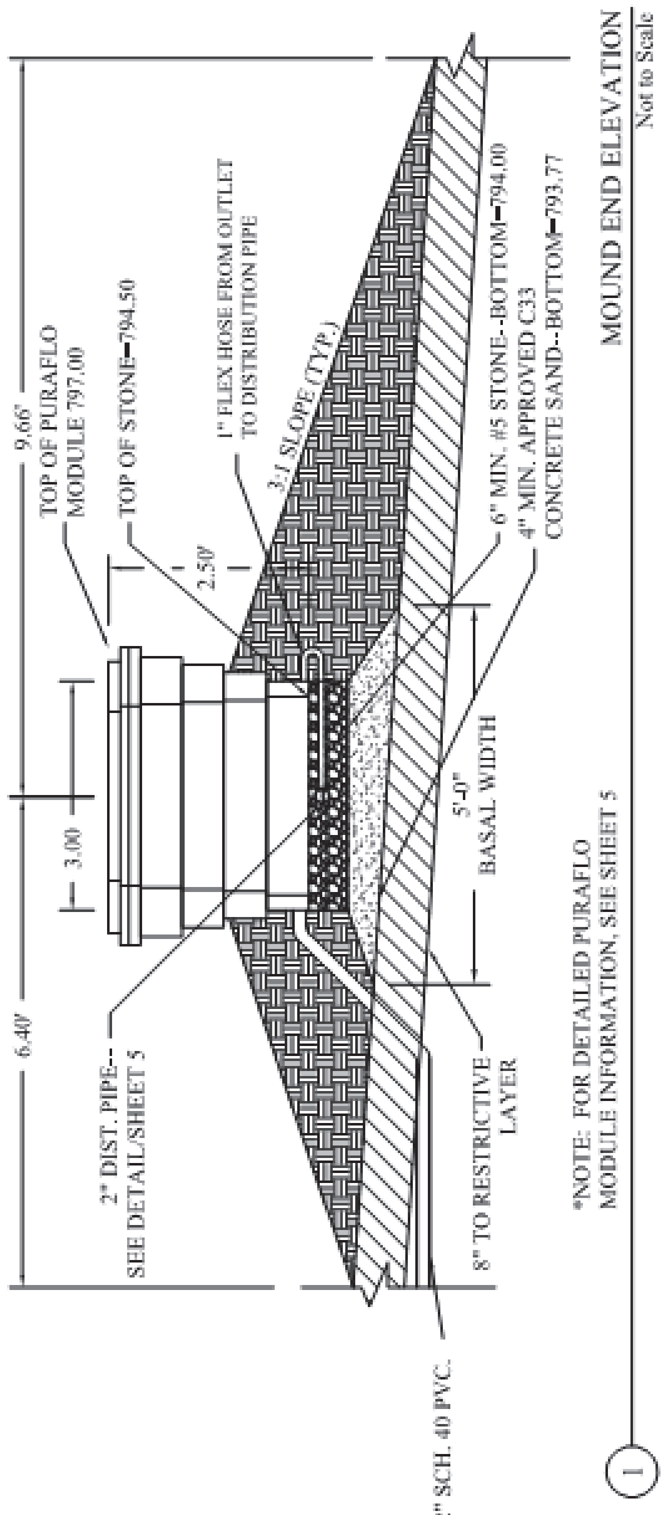

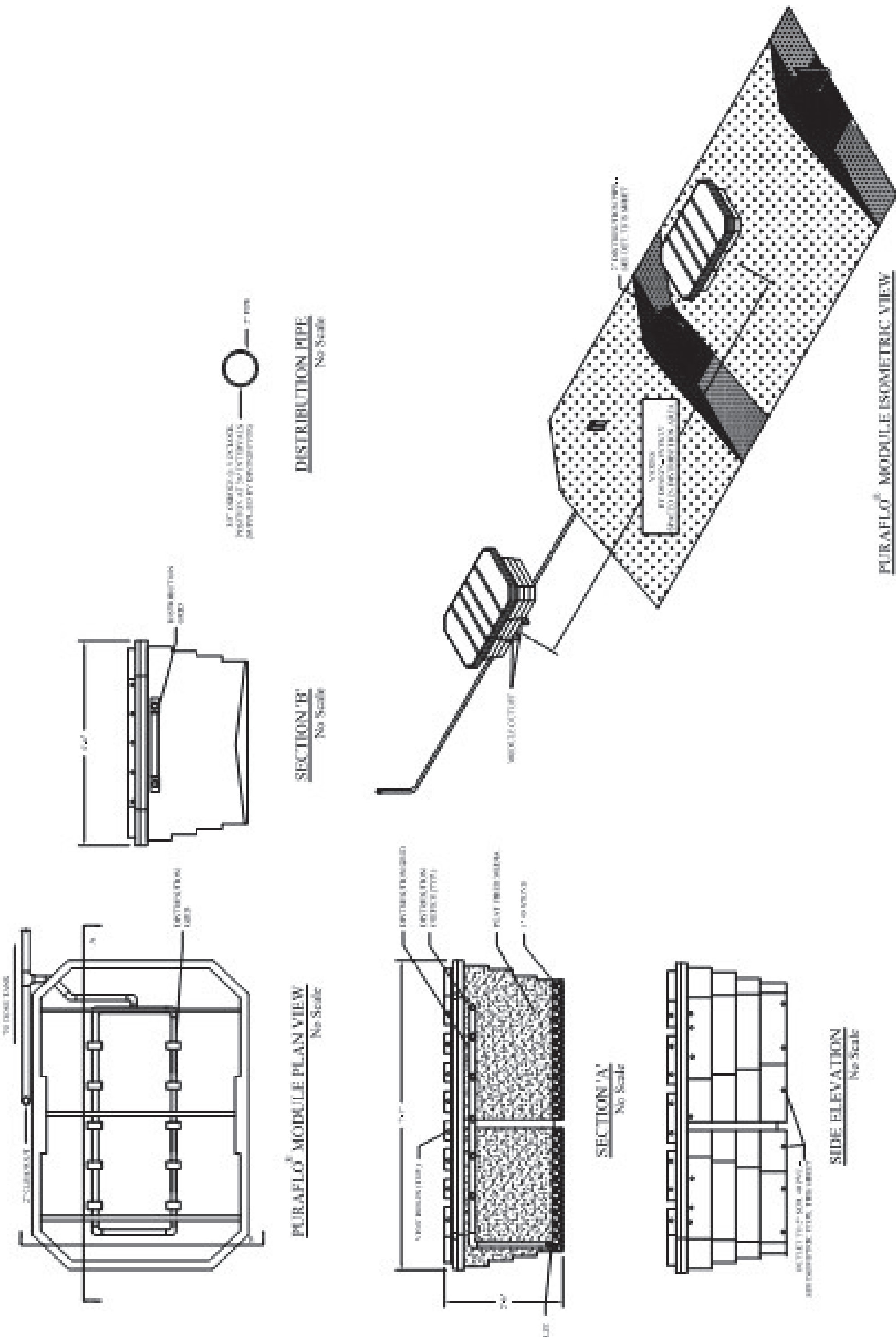
PURAFLO® MODULE PLAN VIEW
No Scale
SECTION 'A'
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SIDE ELEVATION
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SECTION 'B'
No Scale
DISTRIBUTION PIPE
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PURAFLO® MODULE ISOMETRIC VIEW
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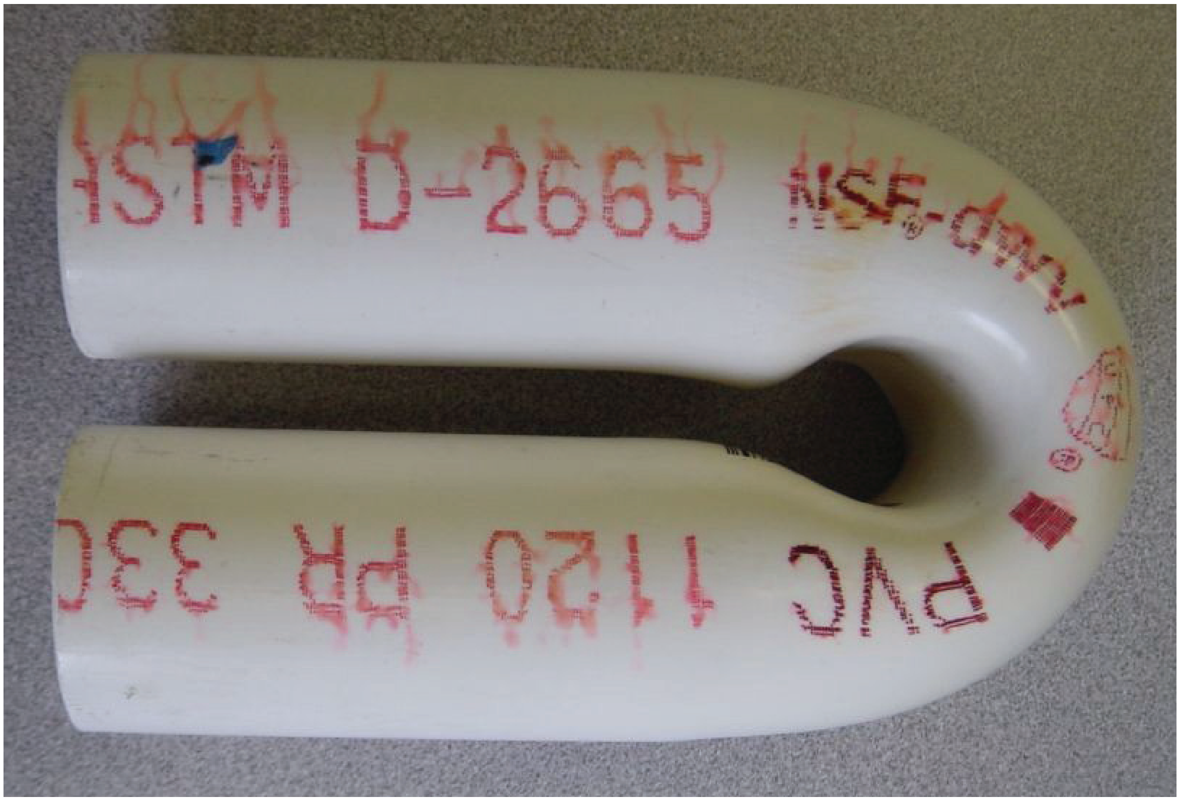
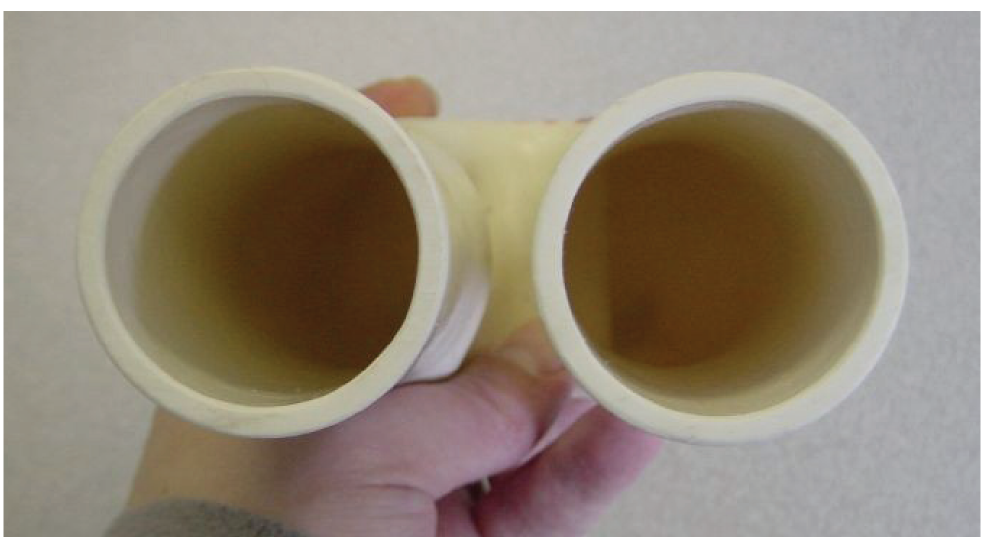
PICTURES-MOUNDED PAD CONNECTION PIPE FROM MODULE TO LATERAL PIPE UNDER MODULE





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Type B System - Puraflo® Modules with SEPARATE Dispersal

- Refer to section 5 and 9 of this manual.
- All components used in conjunction with the Puraflo® Peat Fiber Biofilter must comply with all applicable Wisconsin rules and codes.
- The septic tank shall be sized according to the NSF testing criteria, which can be figured by dividing the daily design flow by 0.9 or according to state or local code.
- An effluent filter/screen shall be placed on the outlet of the septic tank that meets the requirements of Section 5.3 of this manual.
- The pump tank shall be sized according to the NSF testing criteria, which can be figured by dividing the daily design flow by 0.9 or according to state or local code.
- The design of the dispersal area for the Puraflo® Peat Fiber Biofilter effluent shall be comply with OAC 3701-29 and be sized according to the soil application rates in the Tyler Table ≤30 mg/l BOD_5.
- The minimum vertical separation distance is 1 foot from limiting conditions.

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